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THE ELECTRIC LIGHT IN THE CITY OF LONDON.

SOME interesting statistics are to be found in the recently-issued Report to the Streets Committee, by Mr. William Haywood, the engineer and surveyor to the Commission of Sewers. It deals of course exclusively with the experiments of the past year, commencing from the 1st of April, 1881, and ending on the 31st March of the present year. It is well known that the Electric Light and Power Generator Company (Maxim-Weston) did not commence on the strict terms of their contract until the 27th of April of this year, therefore the matter contained in Mr. Haywood's report is chiefly confined to the systems of Messrs. Siemens Brothers and the Anglo-American Brush Company. One of the most interesting items in connection with the use of the electric light in the City is that relating to its defects and failures. In the Brush district were 33 lamps, each assumed to be alight for 4,300 hours during the twelve months, this being equal to a total of 141,900 hours' lighting of a single lamp. The total number of the failures which happened to this system from all causes amounted to 660, counting each failure each night separately, and the aggregate duration of such defects equalled 3,142 hours' burning of a single lamp, or about 2·21 per cent. of the entire lighting of the district for the year. The causes assigned for these failures are very numerous, amongst them being many which will probably not be likely to occur again, such as: lace of driving-band broke; switched out maliciously; changing the working power of circuit from one motor to another; defects in carbons; carbon-rod sticking; top carbon falling from socket; neglect in trimming; bad insulation of cables; carelessness of men employed on circuit; defective mechanism of lamp, &c., &c.

The total number of failures from much the same reasons as above, chronicled for the system of Messrs. Siemens—having 34 lamps in action, and equalling a total of 146,200 hours' lighting from a single lamp—were 320, or approximately only half of those credited to the Brush, their aggregate duration, however, being only 832 hours of a single lamp, or about 0·57 per cent. of the entire lighting of the district for twelve months.

Speaking roughly, there occurred in the Brush system a defect of long or short duration in something less than two lamps nightly, and in that of Siemens Brothers a similar defect in something like one per night. In both systems failures happened through bad insulation, the first cable of the one not being sufficiently good to begin with, and that of the other being damaged by a barge, part of the cable being beneath London Bridge. Although these partial failures were numerous, the result at the end of the year was really better than might have been expected, even by those who are the most conversant with the management of the apparatus connected with the electric light. Even gas, however, has a bad record against it in this respect, for out of a total of 3,225 lamps, the number of defective lights observed in 1881 amounted to no fewer than 2,509, and this only includes burners, in which the defect is very noticeable. This number, which according to the Report was much in excess of what is usual, is attributed to the long continued and severe frosts.

Whenever any accident occurred to the electric lamps but little inconvenience was felt by the public, as arrangements were made with the gas company for burning gas where these partial interruptions happened. The expense of this was borne by the electric lighting contractors, and in the case of Brush the amount came to £129 14s. 7d., and for Siemens £122 9s. 7d.

The electric lamps were alight in the day-time during the fogs of December 9th last, and also on the respective dates of the 18th, 25th, and 29th of January, together with the 2nd, 3rd, 6th, and 7th of February. The cost of the electric light during these fogs was as follows:—Brush, £25; Siemens, £21 3s. 9d.

It is only necessary to mention that the Commission of Sewers arranged with the Brush Corporation for a further period of twelve months lighting, at a cost of £800, being £140 in excess of the charge for the preliminary year's work. Messrs. Siemens Brothers requiring for a continuance of their contract £1,330 in excess of their original price; their offer was declined, and the district for the present returns to gas.

A second report from the Streets Committee relates to proceedings relative to the applications for an extension of the electric lighting experiments. According to the abstracts of tenders prepared by Mr. Haywood, and received for lighting the four districts set apart for this purpose, it appears that there are seven contractors desirous of obtaining the work. Their names are as follows:—G. D. Cardew, employing G. H. Long's patent electric lamps and machines; the Electric Light Engineering Company, with the arc lamp of Mr. A. A. Common, but machines not described; the Electric Light and Power Generator Company, with the Weston machines and arc lamps, as now in use along Queen Victoria Street; Mr. A. L. Fyfe, lamps and machines not described; James Fyfe, with two tenders for the Pilsen arc and the Joel semi-incandescent lamps respectively; the Hammond Electric Light and Power Supply Company, using Brush machines and lamps; and last, the Laing Electric Light and Power Company, proposing to employ the Laing machines and lamps. The second and third mentioned contractors stipulate that they should have permission to light private premises, the Electric Light and Power Generator Company, however, tendering for No. 1 district only.

We gave in our last issue an extract from a letter written by Mr. Alexander Peebles, relating to the prices quoted for the various districts by the competing companies. We may add that for district No. 1 the highest and lowest tenders are those of the Electric Light and Power Generator and the Hammond Electric Light companies, with £5,750 and £2,190 respectively. For district No. 2, G. D. Cardew and the Laing Company, with £4,270 and £2,350, are respectively highest and lowest. In tendering for No. 3 district James Fyfe, with the Joel system, £3,800 is highest,

and the Hammond and Laing Companies, with the same estimate of £2,470, lowest. For No. 4 district, James Fyfe, with the same system, is again highest—£4,350, and the Laing Company, with £2,920, lowest. These tenders are all for the total cost of a twelvemonth's trial. It is only fair to add, however, in the case of Mr. Fyfe, with the Joel and Pilsen systems, that he would, if permitted to light private premises, make the charge for street lighting the same as the gas saved, plus 20 per cent.

The percentage of variation in the estimates sent in will be found in the letter of Mr. Peebles before referred to, and this variation bears out, to a certain extent, the following extract from the *Globe*:—

> It ought, one would think, to be possible, after all the investigations which have taken place, to say once for all whether electric lighting or gas lighting is the cheaper, but if we may judge from a long letter sent to us by Mr. H. Saxon Snell, the controversy is still very much *sub judice*. The tenders for a given job, obtained by Mr. Snell from three several electric light companies, differed very much as contractors' tenders are apt to differ, and all were far beyond what, according to Mr. Snell, the cost of gas would be.

The estimated cost for lighting the four districts, taken in rotation, is £551, £363, £341, and £612.

The Streets Committee conclude their report in the following manner:—

> Looking at the experiments which the Commission have already carried out, and the great cost of extending the same, as shown by the offers now submitted, we are not prepared to recommend your Honourable Court to proceed further in the matter at present, the more so as by the bill now before Parliament, and draft amendments suggested by the Board of Trade, it is proposed to give power to the local authorities to supply electricity, not only for public but for private purposes, or to acquire compulsorily the undertakings of other parties after fifteen years from the passing of the Act under which they may be empowered, and until Parliament has decided the principle upon which electric lighting generally shall be permitted, we consider it undesirable to incur further expense beyond that to which the Commission are already committed by the experiments now in operation.

THE EDISON DYNAMO-ELECTRIC MACHINE.

[We extract from the excellent journal of the Franklin Institute of America the following description of the Edison steam dynamo, a paper on which was read by T. A. Edison, Ph.D., and Charles T. Porter, at the Philadelphia meeting of the American Society of Mechanical Engineers, April, 1882. Containing, as it does, much that is new regarding what is known here of the performance of these machines, it will be welcome to those of our numerous readers interested in electric lighting. The original paper contains a perspective illustration of the combined engine and machine, which it is not necessary to reproduce, as the Edison machine has already been given by ourselves (see "ELECTRICAL REVIEW," November 5th) and other journals in this country. There are also several sketches of mechanical details, and five indicator diagrams taken from the engine, which need only be referred to.]

THE central Edison station of the first district in New York City will, when fully equipped, be supplied with twelve dynamos, each of which is nominally rated as a 1,200 light machine, at 16 candle-power incandescence, but is capable of supplying 1,400 lights of this power continuously, and with high economy, without heating the armature or burning or injuring the commutator or brushes. This increased capacity is due to improvements in the lamp itself.

The armature of each dynamo is driven by a Porter-Allen engine, of $11\frac{3}{16}$″ diameter of cylinder, by 16″ stroke, directly connected, and making 350 revolutions per minute, giving a piston travel of 933 ft. per minute.

The steam is supplied by eight Babcock and Wilcox boilers, of 2,000 aggregate horse-power, and which will work under a pressure of about 120 pounds. These occupy the basement of the building. Over them, the first and second floors being removed, an iron superstructure is erected entirely separated from the walls of the building, and on this the combined dynamos and engines are placed.

One-half of this equipment is now nearly ready for service, and the remainder is expected to be completed during the coming season.

The armature of the dynamo is of the form commonly known as the Siemens armature, but in its construction and "connecting up" it differs radically from all others.

The foundation of the armature, or the iron core which is built upon the shaft, is made up of sheet-iron discs, separated from each other by sheets of tissue paper, and bolted together. This has all the advantages of a solid iron core in strengthening the magnetic field, while it completely prevents the great loss of power by local currents, which would circulate in the iron if it were solid. In the place of insulated wires, the cylindrical face of the armature is made up of heavy copper bars, trapezoidal in section, each bar being insulated, and also separated from its neighbours and from the iron core underneath by an air space.

The connection between the bars on opposite sides of the armature, to form the electrical circuit, is made by copper discs of the same diameter as the core. At each end of the core are one-half as many of these copper discs as there are bars, each disc being insulated from its neighbours, and the whole being bolted together in such a manner as to form, with the discs of sheet-iron constituting the core, one solid mass. Each disc is formed with projecting lugs on its opposite sides, to which the two bars are connected.

The connections between the opposite surfaces of an armature are of no benefit in generating an electric current, but are a necessary evil, introducing useless resistance into the circuit. By using for this connection copper discs in the manner described, a great weight of copper is disposed in a limited space, and so this useless resistance, and consequent loss of energy, is reduced to a minimum.

This method, moreover, reduces the work to a simple machine construction, in which all the parts are duplicates, and the operations can be much cheapened and facilitated by the use of special tools.

The spaces between the armature bars admit of a free circulation of air, thereby preventing the accumulation of heat, and increasing to an enormous degree the capacity of the machine. The armature is at intervals wound with piano wire over the bars to resist the centrifugal force developed by their revolution.

The commutator and brushes of an electrical machine are the parts subject to the greatest depreciation. In this machine all parts of the end of the armature are so constructed as to be easy of access, and they can be quickly and cheaply repaired, or removed and replaced by new parts, when necessary. Any accident would require but a short stoppage for repairs.

Provision is made for keeping a continuous and rapid circulation of air over the entire face of the armature.

This armature is 27·8″ in diameter by 61″ long. The commutator adds 18″ to this length, and is itself $12\frac{3}{4}$″ in diameter. The armature shaft is of steel, $7\frac{1}{4}$″ in diameter, having a total length of 10·3″. The journals are $6\frac{1}{2}$″ in diameter by 15″ long, and run in Babbit metal bearings in pillow blocks of the box form, giving the greatest stiffness with minimum of weight.

Provision is made for continuous water circulation underneath the boxes, and for continuous lubrication, with traps to prevent the creeping of the oil along the shaft and reaching the commutator, and drains to receive it as it runs through the bearings and convey it to a drip-pan.

The magnet is made up of two immense cast-iron "pole-pieces," between the semi-cylindrical faces of which the armature revolves, twelve cylindrical soft iron cores attached to these pole-pieces, and made magnetic by an electrical current circulated in the wire wound around them, and four soft iron keepers connecting the back ends of the cores. Eight of the cores are attached to the upper pole-piece, and four to the lower one.

The width of these "poles" is 49″, and their height $61\frac{1}{2}$″. The length of the twelve soft iron cores is 57″, the diameter

of the eight upper ones is 8″, and of the four lower ones 9″. The four soft iron keepers are each 11″ wide, 9″ in thickness, and the total length of the magnet is 94″.

The magnet is insulated by cast zinc bases 3″ in thickness.

The weight of the dynamo is as follows:—

Armature and shaft - -	9,800 lbs.
Two pillow blocks - - -	1,340 „
Magnet, complete - - -	33,000 „
Zinc bases - - - -	680 „
Total - - -	44,820 lbs.

The copper is distributed as follows:

In the armature bars - -	590 lbs.
„ „ discs - -	1,350 „
„ magnet wire - -	1,500 „
Total - - -	3,440 lbs.

Mr. Edison was early impressed with the conviction that to give steady and reliable motion to these armatures it would be necessary to connect an engine to each one of them directly. This combination has been termed by him the "steam dynamo."

In adapting the Porter-Allen engine to this service, a special construction in some respects was found to be called for. These special features will be briefly described.

It seemed important to avoid a rigid connection between the engine and the armature shafts, which would require the entire series of bearings to be maintained absolutely in line. In place of this, therefore, a self-adjusting coupling has been introduced, which permits of considerable errors of alignment without any abnormal friction being produced in the bearings.

The point of difficulty was the backlash, the engine having no fly-wheel, except the heavy armature itself, which was to be driven through the coupling. Provision was made for taking this up by steel keys of a somewhat peculiar form, between which the tongues of the coupling move freely, while they themselves are immovable. These keys are held between set screws threaded in wrought iron rings covering the flanges on the ends of the shaft. All the faces liable to move upon each other are oiled from a central reservoir. This coupling is a very compact affair, without a projection anywhere above its surface, and gives every promise of completely answering its purpose.

The engine is made with a forked bed and two shaft bearings and a double crank, and so is completely self-contained.

The shaft having no support beyond these bearings on either side, unusual stiffness was required in the crank-pin to prevent deflection under the great strains to which it is subjected.

A novel form of pin was proposed by Mr. Richards, which is found to possess all the rigidity required. It is provided with flanges which are let into each crank, and held each by four screws, while the shanks of the pin are also forced firmly into the cranks.

Special appliances enabled the work of putting the cranks together in this manner to be done with extreme and uniform accuracy.

The engine is so arranged as to have the valve gear on the side furthest from the dynamo. The engineer has not to go between the engine and dynamo, when running, for any purpose.

The connecting-rod is of steel, and the crank-pin boxes are formed directly in the end of it.

This end is finished from a solid forging, and chambered out for Babbit metal. The bolts are then fitted, after which it is parted and holes are drilled for holding the Babbit securely.

In the connecting-rods for single crank engines of this type permanent length of rod is secured by forming the crank pin end solid, and taking up the wear by a wedge closing up the inside box. In these double crank engines this construction is impracticable, but the same object is attained by forming the crosshead end in a manner by which the strap is made permanent and the inside box is closed up by a key bearing against a steel plate.

The weight of the reciprocating parts of this engine is as follows:—

Piston, with rod - - - - -	83 lbs.
Crosshead - - - - - -	42 „
Connecting-rod - - - - -	109 „
Total - - - - -	234 lbs.

The initial acceleration of this mass or the force required, on the dead centres, to give it the motion necessary to relieve the crank from strain, is as follows:—

$$350^2 \times \cdot 66 \times \cdot 000341 = 27{\cdot}57,$$

or 27·57 times the weight of the mass, which gives

$$234 \times 27{\cdot}57 = 6451 \text{ lbs.}$$

The formula is $r^2\, l\, c$, when

r^2 = the revolutions per minute;
l = the length of the crank in decimals of a foot; and
c = the co-efficient of centrifugal force.

The connecting rod is 48″, or 6 cranks, in length. This affects the initial acceleration, making this to be on the dead centre farthest from the crank 7,526 lbs, and on the dead centre nearest to the crank 5,376 lbs., a difference of 40 per cent.

The area of the cylinder is 98·2 square inches.

The area of the piston rod, 1¼ in. diameter, is 2·4 square inches, leaving area of cylinder at crank end 95·8 square inches.

The initial accelerating forces are therefore as follows, viz.: at the end of the cylinder farthest from the crank 77 lbs., and at the end of the cylinder nearest to the crank 56 lbs., on the square inch of piston area.

The counterweight was after some trials fixed at 135 lbs. This leaves 99 lbs. of the reciprocating parts running unbalanced. It is found that this is not sufficient to disturb the stability of the engine, while on the other hand the counterweight is not so great as to exert an objectionable strain in the vertical direction.

The total weight of the engine is 6,445 lbs.

The engine and dynamo are mounted on a cast-iron base plate, made for convenience in two parts, and bolted together.

The dimensions of this base plate are as follows: length 14 ft., width 8 ft. 9 in.; and its weight is 10,300 lbs. The entire weight is therefore as follows:—

Base plate - - - - -	10,300 lbs.
Dynamo - - - - -	44,800 „
Engine - - - - - -	6,450 „
Total - - - - -	61,550 „

The last and most careful test of one of these dynamos gives the following results, as shown by the indicator diagrams; scale 80 lbs. to the inch.*

The lamps used in all the trials were of the older construction, of which 8½ lamps, at 16 candle-power incandescence, require one horse-power of electrical energy.

Since these were placed for experimental uses, improvements in the lamp have increased their economy, so that one horse-power is sufficient to maintain fully 10 of the present lamps at 16 candle-power incandescence.

	Horse-power.
Diagram No. 1 shows the friction of engine and dynamo at 350 revolutions per minute, requiring	13·63
Diagram No. 2 shows the resistance with the magnet circuit on = - - - - - -	19·17
Field 5·78 ohms, 103 volts.	
The increased resistance due to the magnets was -	5·54
Of this, the calculated energy developed in the magnets was $\frac{103^2 \times 44{\cdot}3}{5{\cdot}87 \times 33{,}000}$ = - - -	2·46
Leaving energy to be accounted for by local currents in iron core of armature, and in armature bars - - - - - - - - - -	3·08

* As many persons might doubt about these diagrams having been really taken from any engine and by any indicator at this speed, we have examined the originals taken by a Tabor indicator, and can vouch for their accuracy.—ED. J. F. I.

Diagram No. 3 shows the work done in maintaining 300 lamps.

These, in the ratio of $8\frac{1}{2}$ to 10, were equal to 353 lamps of the present construction. The pressure was maintained also at 102 volts, representing 25 candle-power, in place of 98 volts, representing 16 candle-power incandescence, which requires the number of lamps to be increased in the ratio of 102^2 to 98^2, or to 382 lamps.

The pressure at the armature was 104 volts, showing a loss in the conductor of 2 volts, which would increase the number of lamps as 104 : 102.*

The total correction is therefore as follows :—

$$300 \times \frac{10}{8{\cdot}5} \times \frac{102^2}{98^2} \times \frac{104}{102} = 389 \text{ lamps.}$$

The power exerted was - - - 60·6 horse-power.

Which gives to the indicated horse-power

$$389 \div 60{\cdot}6 = 6{\cdot}42 \text{ lamps.}$$

The magnet circuit had now a resistance of 5·28 ohms with 104 volts pressure, representing

$$\frac{104^2 \times 44{\cdot}3}{5{\cdot}28 \times 33{,}000} = 2{\cdot}75 \text{ horse-power.}$$

Substituting this in place of 2·46 horse-power in the first trial, we have 19·46 horse-power, which, deducted from 60·6 horse-power, leaves net 41·14 horse-power.

This gives 389 ÷ 41·14 = 9·45 lamps per horse-power.

Diagram No. 4 shows the work done in maintaining 700 lamps.

The pressure at the lamps was maintained, as in the preceding trial, at 102 volts, which required at the armature a pressure of 105 volts.

The total correction in this case is therefore

$$700 \times \frac{10}{8{\cdot}5} \times \frac{102^2}{98^2} \times \frac{105}{102} = 919 \text{ lamps.}$$

The power exerted was - - 115·83 horse-power, giving to the indicated horse-power,

$$919 \div 115{\cdot}83 = 7{\cdot}93 \text{ lamps.}$$

The resistance of the magnet circuit was now 4·78 ohms, with 105 volts pressure, representing

$$\frac{105^2 \times 44{\cdot}3}{4{\cdot}78 \times 33{,}000} = 3{\cdot}1 \text{ horse-power.}$$

Substituting this in place of 2·46 horse-power in the first trial, we have 19·81, which, deducted from 115·83 horse-power, leaves net 96·02 horse-power.

This gives 919 ÷ 96·02 = 9·57 lamps per horse-power.

Diagram No. 5 shows the work done in maintaining 1,050 lamps.

The pressure at the lamps was maintained in this trial at only 99 volts, but this required at the armature a pressure of 108 volts, showing a loss of 9 volts in conduction.

The total correction in this case is thus

$$1050 \times \frac{10}{8{\cdot}5} \times \frac{99^2}{98^2} \times \frac{108}{99} = 1375 \text{ lamps.}$$

The power was - - - - 168·4 horse-power, giving to the indicated horse-power

$$1375 \times 168{\cdot}4 = 8{\cdot}16 \text{ lamps.}$$

The resistance of the magnet circuit was now 3·28 ohms, with 108 volts pressure, representing

$$\frac{108^2 \times 44{\cdot}3}{3{\cdot}28 \times 33{,}000} = 4{\cdot}77 \text{ horse-power.}$$

Substituting this in place of 2·45 horse-power in the first trial, we have 21·48 horse-power, which, deducted from 168·4 horse-power, leaves net 146·92 horse-power.

This gives 1375 ÷ 146·92 = 9·36 lamps per horse-power.

* The conductors were insufficient, occasioning a loss, that increased with the increase in the number of lamps

It will be seen that the losses of efficiency due to undiscovered resistances are only

In the first case, 10 — 9·45 = ·55 horse-power per lamp.
In the second case, 10 — 9·57 = ·43 „ „
In the third place, 10 — 9·36 = ·64 „ „
Averaging 5·4 per cent.

The friction in the journals of the armature, when driven in this manner, does not increase with the resistance, and, on account of the action of the reciprocating parts of the engine, that in its bearings is also nearly a constant quantity, whatever the load may be.

The above figures show this very clearly, the subtraction of the friction diagram in each case exhibiting substantially the same net power per lamp.

KETTELL'S INDIVIDUAL TELEPHONE CALL AND SIGNAL.

THE progress which telephonic communication has made in England is but small compared with that made in America. The network of wires which has been spun all over the business portion of the Metropolis, and to some extent outside the City limits, would seem to contradict this statement; but it is only necessary to mention the fact that Worcester, a city in Massachusetts, of 63,000 inhabitants only, has more subscribers in telephonic communication than have all the exchanges in London, when it will be seen at once that what we say is correct. In countries where the use of the telephone is so extensive it is but natural that every effort should be made, not only to render the communication as effective but also as cheap as possible, hence it is that we find here so many telephonic exchange patents taken out by inventors in America, for cheapness of communication, to a very great extent, depends upon the exchange system employed.

Up to the present the arrangements of the exchanges in this country have been of the simplest character: every subscriber has a wire in direct communication with an exchange office, at which place he can be switched through to any subscriber he may require; if it should happen that there are, say, six subscribers who are at a short distance apart on a direct line from the central office, still, with the present system, each of these subscribers must have a separate wire. Now it is evident that any device by which these six subscribers could be simply looped in on a single wire common to all, must lessen the outlay necessary to establish the communication, and must enable the latter to be supplied at a less rental than that demanded at present. It is of course necessary that the means by which the object in view is carried out be of a much less cost than that which would be required for the erection of a number of wires, for the lessening of the rental to a subscriber must be sufficient to compensate him for one small disadvantage inherent in a system in which a number of instruments are placed on one circuit, namely, that one subscriber has to wait until another subscriber has terminated his use of the circuit on which the two are looped, and has left the line clear. As a rule, however, the period of waiting does not exceed three minutes, a length of time which it is hardly worth while taking into consideration.

The proof of the pudding is the eating, and the system which we are about to describe has, by practical use over a period of a year and a half, proved that such an arrangement as that of looping several subscribers (as many as 10 have been so looped) on one wire, can be adopted with perfect success.

The solution of the problem has been more than once attempted, but, we believe, with but indifferent success. The system of Mr. Kettell is, in our opinion, the best which has yet been brought into practical use, and promises to be extensively employed.

The devices by which the apparatus is worked are of great mechanical ingenuity, and are very suggestive of applications to other purposes, and even for this reason the system is worthy of being described.

In order to explain the action of the instruments, it will

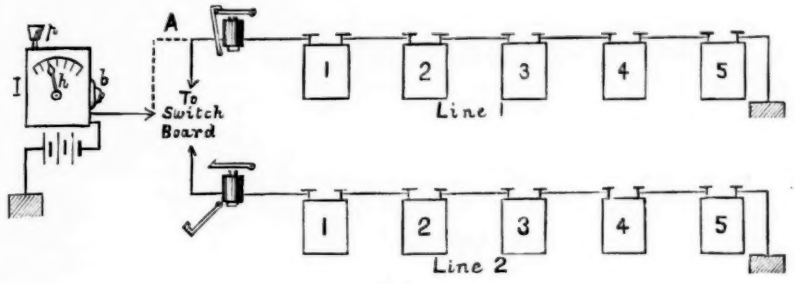


FIG. 1.

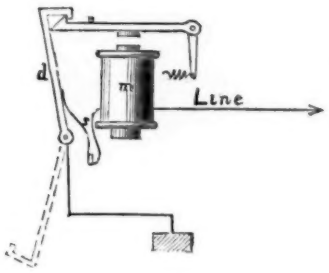


FIG. 2.

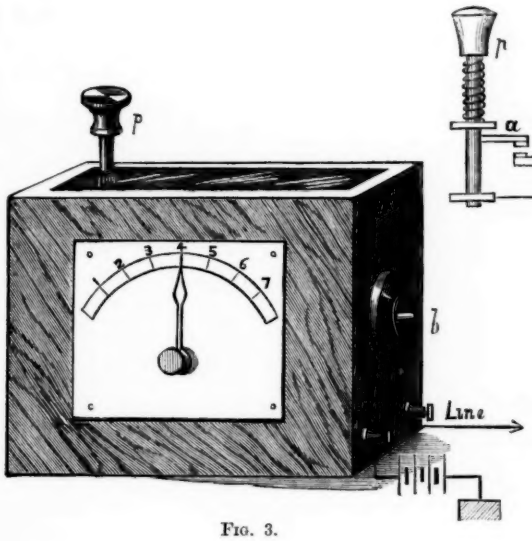


FIG. 3.

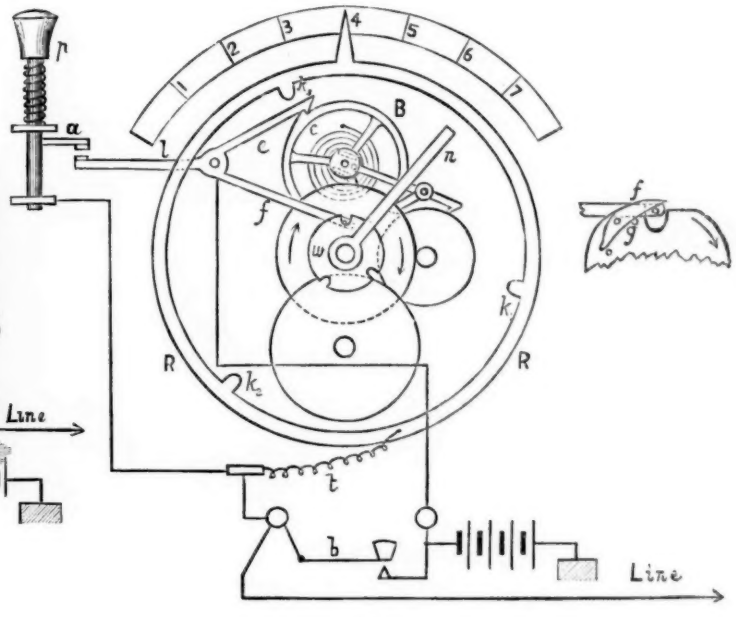


FIG. 4.

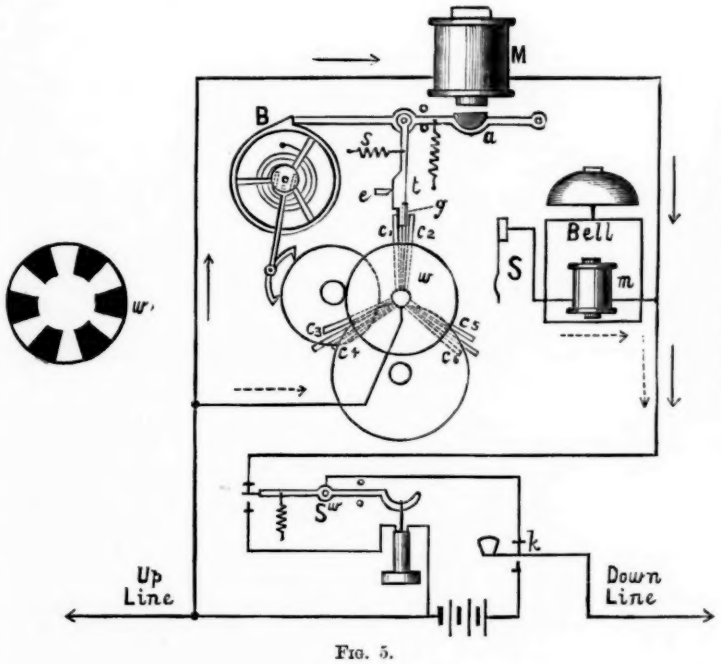


FIG. 5.

FIG. 6.

be advisable to consider the general arrangement of the system :—

Fig. 1 shows two lines running into a central exchange at A, each line having 5 subscribers looped into it ; there may of course be any number of lines with a number of subscribers on each, but two will be sufficient for the purpose of the description.

Suppose now that subscriber 3, on line 2, wishes to communicate with subscriber 5, on line 1, then the following operations take place :—Subscriber 3 presses a push-button attached to his instrument, and thereby sends a current through all the instruments on the circuit, and also through a drop indicator at the central station, thus calling the attention of the latter. The indicator is of the usual form, but is arranged as shown by fig. 2, that is to say, the circuit from the electro-magnet, instead of passing direct to earth, goes to the latter through the medium of the contact spring, *s*, and the drop, *d*, so that when the latter has fallen to the position shown by the dotted line, the circuit becomes disconnected, and no more currents can be sent by pressing the press-button. The current which passes through the instruments of the various subscribers sets free some mechanism, which causes a small indicator on each instrument (seen just below the 5 in fig. 6) to turn and indicate that the line is occupied.

As soon as the central exchange station receives the call he switches his telephone in circuit with the line and communicates with the subscriber, who announces his number and also states with whom he wishes to communicate. As we have before said, let it be subscriber 5, on line 1. The exchange station now switches the apparatus, I (fig. 1), shown in outward form by fig. 3, on to line 1 (this connection is represented by the dotted lines in fig. 1) ; he then sets the hand, *h*, to indication 5, and depresses the push, *p*. The result of this is to ring the alarum of subscriber 5, and to turn the indicators of the instruments of *all* the subscribers to the position which indicates that the line is occupied; *but the alarums of the subscribers other than number* 5 *do not ring*. As soon as the exchange station observes that the mechanism of his apparatus (fig. 3) has ceased to run, he disconnects the latter and switches line 1 in communication with line 2 ; the subscribers thus put into connection communicate with each other. At the end of three minutes (which is the time allowed for a subscriber to converse) the exchange disconnects the two lines, and having again connected the instrument, I (fig. 1), to line 1, he depresses the button, *b*, once ; this sets the indicators of all the subscribers to the position indicating that the line is clear ; line 1 is then connected again to its drop indicator, and the instrument, I, is connected to line 2, the button, *b*, depressed once, the instrument, I, disconnected, and line 2 connected again to its drop indicator.

It will be evident that the peculiarity of the apparatus consists : 1st, in the arrangement by which the currents (*two* currents, as will be seen) sent by the depression of the stud, *p*, move the indicators of all the instruments to the position indicating that the line is occupied ; 2nd, in the arrangement by which the alarum of only one subscriber is sounded ; 3rd, in the arrangement by which the depression of the push, *b*, sets all the indicators to "line clear."

Fig. 4 shows the internal arrangements of the apparatus (fig. 3) at the exchange station. Fig. 5 shows the internal arrangements of the instruments at the subscribers' offices ; an outside view of one of these instruments is shown by fig. 6. It must be understood that figs. 4 and 5 only show the general arrangements of the apparatus, the actual forms of the latter differ slightly in detail from the figures, though the general principles are identical.

Referring to fig. 4, let us suppose the stud, *p*, to be depressed and then immediately allowed to rise again. When the depression takes place, the projecting piece, *a*, comes in contact with the lever, *l*, and as the zinc pole of the battery is connected to *l*, and the line to the push, *p*, a current flows out to line, but ceases immediately the pressure is taken off *p*. The movement of the push has, however, depressed the lever, *l*, and caused the hook at the end of the prong, *e*, to disengage from the projection, *c*, on the balance-wheel, B. This balance-wheel is in gearing with a train of wheels driven by a strong spring—the whole mechanism of an American lever clock, in fact. The balance being released, the clockwork mechanism starts off in action. Now the movement of lever, *l*, also lifts a pin at the end of the prong, *f*, out of a notch in wheel, *w*, but as the movement of this wheel is comparatively slow, the pin would drop again into the notch and stop the train of wheels unless previous to *p* being allowed to rise, the wheel, *w*, has moved round through a few degrees ; practically, however, the depression of *p* being only momentary, the wheel, *w*, will not have turned sufficiently to make the pin drop on to the circumference of *w*, instead of into the notch ; so to avoid this difficulty the device shown to the right of the figure is adopted. On the face of the wheel, *w*, and near the circumference, there is set at each notch a small pawl, *g*, which falls to the position shown, by its own weight ; when the prong, *f*, rises, the pin lifts up the pawl and, on clearing it, the latter drops back to its original position, thus closing, as it were, the notch and preventing the pin of the lever dropping back again. Supposing now the wheel, *w*, continues to rotate with the pin of the lever resting on its circumference, then this pin will be able to drop into the next notch, since it will enter towards the latter underneath the pawl. When the pin drops back into the notch, the prong, *e*, is ready to engage in the projection, *c*, of the balance wheel, B, which it does when the balance has swung nearly to the limit of its angular movement, so that when disengaged, the balance is ready to start off in full action immediately.

We see then that the momentary depression of *p* will start the clockwork ; and as there are three notches in *w*, the movement will go on until *w* has turned through a third of a complete revolution ; or as *w* turns once in a minute, the clockwork will run for one third of a minute before it stops.

Fixed on the axis of *w* is a light hand, *n* ; this hand in a complete revolution makes contact with metallic projections, k_1, k_2, and k_3, successively ; the projections are fixed on a metal ring, which can be turned through any desired angle by means of the pointer, *h* (fig. 3). It is evident therefore that the period which will elapse before the hand, *n*, makes contact with any one of the projections will depend upon the position of the pointer, *h* ; if the pointer is set at division 1, for example, then on the clockwork being started contact will be made by the hand, *n*, almost immediately ; but if the pointer be set at division 7, then a longer period will elapse before the contact occurs. The hand, *n*, being in connection, through the wheelwork, with the lever, *l*, and the ring, R, being in contact, through the flexible connection, *t*, with the push, *p*, it is evident that the result of the contact will be to send a current out to line. The depression of the push, *p*, in fact, sends a momentary current out to line, which current will be followed after a certain interval, which is adjustable, by a second momentary current. The possible angular movement which can be given to the ring, R, is less than one-third of a complete circle, whilst the hand, *n*, is so fixed on the arbour of *w* that when the pointer, *p*, stands at division 1 (the left hand limit of its movement) this hand is a little behind one of the projections on the ring, R. It follows from this that no matter what be the position of the pointer, *h*, the hand, *n*, after touching a projection, will always advance beyond it before stopping.

Referring now to fig. 5 let us suppose that the first current has been received from the central station, then this current comes from, say, the Up line, passes through the electro-magnet, M, and from thence through the switch lever, S^W, and the key, *k*, to the Down line. The electro-magnet being excited pulls up the lever, *a*, and the end of the latter disengages from the balance-wheel, B, and allows the clockwork mechanism in connection with B to run. Attached to the lever, *a*, is a toggle, *t*, which tends to move to the left under the influence of the spring, *s*. As soon as the lever, *a*, is lifted up, the projecting piece on this toggle hitches over the stop, *e*, being drawn over it by the spring, *s*, so that when once attracted, the lever, *a*, is unable to fall back to its normal position and stop the balance, B, the clockwork, therefore, will continue to run. The end of the toggle, *t*, it will be seen, touches against the right hand side of an arm, c_1, which arm is fixed to the axis of the wheel, *w* ; now the length of the end of the toggle is such that if the latter is just hitched on the stop, *e*, this end would not quite clear the arm, c_1 ; if however the toggle is raised a little higher, then the end will clear, and as *t* is pulled to the left by the spring, *s*, it follows that when *t* is lowered until its projection banks on the stop, *e*, the end of *t* will come down on the *left* hand side of c_1, so that *w* can revolve without obstruction. The limiting stops of the lever, *a*,

are so adjusted that the movements referred to can take place as indicated.

Let us, then, suppose that the lever, *a*, has been raised and released again so that the toggle, *t*, has become raised over the end of c_1, and let down on the left hand side of the latter, and that *t* has become hitched on to *e*, so that the balance-wheel, B, is free to move and the clockwork mechanism to turn, then the wheel, *w*, which revolves once in a minute like the wheel, *w*, in fig. 4, rotates until the arm, c_3, comes round in contact with the end of the toggle; the latter is then pushed off its stop, *e*, and allows the lever, *a*, to fall and lock the balance, B.

Now the arm, *g*, which is also fixed to the axis of *w*, in the course of its rotation comes in contact with the spring, S, and if it should happen at that particular moment that a second current is sent through the line, then this current will divide, part passing through M, and actuating the lever, *a* (this movement, however, effecting no change in the condition of affairs), whilst the other half of the current (dotted arrows) passes through the magnet, *m*, of the Bell, and by releasing its mechanism causes it to sound. If however the current should come either *before* or *after* the arm has made contact with the spring, then this current cannot pass through the Bell.

Now we have seen that the interval of time which elapses between the transmission of a current by the depression of the stud, *p* (figs. 1, 3, and 4), and the transmission of a second current by the arm, *n* (fig. 4), can be regulated by the pointer, *h* (fig. 3), if therefore the contact springs, S, on the instruments of subscribers 1, 2, 3, 4, 5, 6, and 7, are so arranged that when the mechanisms of all the instruments are set going the first contact is made in instrument 1, the second contact in instrument 2, the third in instrument 3, and so on; and further, if the positions of the springs are so adjusted that the interval of time intervening between two successive contacts is the same in every case, then it is evident that if the pointer, *h* (fig. 3), be set at, say, division 5, then the contact made by the arm, *n* (fig. 4), will be made at the same time that contact is made by the spring, S, on the instrument of subscriber 5.

Attached to the wheel, *w* (fig. 5), is an indicating disc, w_1 (*see* figure at side). This disc is divided into twelve divisions, six white and six red. This disc is set behind the aperture W_1, seen in fig. 6, which has openings cut in it, so that when the disc makes a twelfth of a revolution the red spaces disappear, and the white take their place, or *vice versâ*.

In the position of the apparatus shown in fig. 5, the white portions of the disc appear (showing that the line is clear), and the same will be the case if the arm, c_4, or arm, c_5, be touching the toggle, *t*. If, however, either arm, c_2, c_3, or c_6, be against *t*, then the red portions will be exhibited (showing that the line is occupied).

It has been explained that when a subscriber calls the central exchange station he depresses his call button, *k*, fig. 5, and sends a current. The effect of this is to cause the lever, *a*, fig. 5, in each instrument on the circuit to be attracted, and to set the clockwork mechanisms in action. When arm, c_3, comes round, it unhitches the toggle, *t*, off the stop, *e*, on which it has been lifted and stops the train of clockwork; consequently the red of the discs in each instrument will be exhibited, showing that the line is occupied. As the dropping of the indicator at the central station has disconnected the circuit, no second current can be sent by any subscriber, and consequently the discs being once set at "line occupied," cannot be changed to "line clear," by any one but the central exchange.

Supposing now that the apparatus at the central office is connected to line 1, the pointer set at the number of the subscriber it is required to call, and the push, *p*, depressed, then a momentary current flows out to line, which sets the mechanisms of all the instruments on the circuit in motion, and, as has been explained, causes the bell of the required subscriber to sound; when the mechanism has come to rest, one of the arms, c_3, c_6, or c_2, of the wheel, *w*, in each instrument will be against the toggle, *t*, and consequently the discs will show "line occupied."

After the allotted time for the subscribers to communicate has expired, the apparatus, fig. 3, at the exchange station is conducted to line 1, as was explained at the beginning of the article, and the button, *b*, depressed once, so as to send a momentary current to line; this causes the levers as in each subscriber's instrument to be attracted, and the mechanisms to be released; but these are almost immediately stopped by the second arm, c_4, c_5, or c_1, in each instrument unhitching the toggles; the small angular movements of the discs change their indicators to "line clear." The apparatus, fig. 3, is then connected to line 2, and the same operation is gone through.

The "clearing" current, it will be observed, could be sent equally well by depressing the stud, *p*, instead of the button, *b*; but inasmuch as the apparatus could not be transferred from line 1 for use on line 2 until the clockwork mechanism set free has come to rest, it is preferable to employ the button, *b*.

It will be understood that the switch arrangement, S^w, shown in fig. 5, has attached to it other connections for bringing the usual telephone transmitting battery, transmitter, and induction coil into circuit, but these connections have been left out in the figure to avoid confusion in the important parts of the illustration. These connections being purely local, in no way affect the action of the indicating apparatus.

From the explanations which have been given it must be evident that the invention of Mr. Kettell possesses amongst other advantages one very important one, and that is that the apparatus is self-adjusting. If by any chance it should happen that a signal should fail from a fault in the line wire or from any other reason, the instruments do not require any resetting; this is not the case with other inventions which have been brought out for similar purposes. The mechanism is not at all liable to derangement and does not require heavy battery power to work it, the function of the latter being merely to release the wound-up mechanism, and not to drive it.

The number of revolutions which the wheels, *w*, *w* (figs. 4 and 5), would have to make in a day is so very small that the mechanism would run for a very lengthened period without requiring to be wound up. In the case of the alarum bell this winding up would have to be done more often, but as there is a small indicator ("Wind" fig. 6) connected to the work which shows when the rewinding is required the wheel-inconvenience of the clockwork running down and the bell ceasing to act is not likely to arise.

NEW ELECTRIC LIGHT COMPANIES.

WE notice in the daily press of the present week the advertisement of a new electric light company, and a preliminary notice pending the formation of another. These are respectively the "J. B. Rogers electric light and power," and the "Electric Sun lamp and power" companies. Up to the present we have not considered the electric inventions of Mr. J. B. Rogers of sufficient importance to occupy much space in our columns, and we have only referred on one or two occasions to the various reports which have appeared in certain journals relating to them. Now that a company has been formed for working the numerous patents, English, foreign and colonial, of Mr. Rogers, we purpose making a few remarks in the interests of both electrical engineers and the public. The prospectus, after stating for what purpose the company is promoted, and making a point of its being a parent company, goes on to say,

> The subdivision of the electric current has hitherto been the great desideratum, and the fact that Mr. Rogers obtained the first patent for a system of sub-division, dated 20th September, 1880, which is prior to any other patent for this specific purpose, shows that he was one of the earliest workers in this direction.

This so-called subdivision of the *electric current*, we need scarcely say, has been known as long as the current itself, which is therefore some years before Mr. Rogers began his scientific investigations on the subject of electric lighting. Now, if such a patent could be called valid, why, then, Mr. Werdermann stands some time before the Rogers patent of 1880. The matter contained in this specification, of what we will call out of courtesy an invention, was brought prominently forward by *Iron* on several occasions, and some of the daily newspapers also spoke very highly of the system. It would hardly be fair on our part to stigmatise this portion of what the J. B. Rogers vendors are promoting

as we at first felt disposed, because Mr. Rogers himself, the vendors, *Iron*, and the rest *may* actually believe that there is something in it, and that the patentees' copper globes are really other than "multiple binding screws." We, however, solemnly and sincerely declare our belief that the magic properties of these metallic globes or cups exist only in the imagination of those we have quoted, and that a very near approach to the results of Mr. Rogers has been obtained by Messrs. Edison, Swan, Lane-Fox, &c., independently of such aid.

It may be, however, that we are wrong, for we notice our monthly electrical contemporary gravely states the following :—

> Put broadly, the system amounts to this: Mr. Rogers charges—we must not use the word accumulates or stores—the electricity into certain vessels, something like a large ball-cock of a cistern, and literally taps them to supply practically any number of incandescent lamps. Incidentally it is only fair to Mr. Rogers to say that, having some knowledge of, and respect for, the English tongue, he uses the word "accumulates" purely in the sense of "gathering together," and not in the sense of "storing," as understood and used by modern electricians.

We must, even in the face of this authority, still hold our own opinion, based on the hardly gained experience of many, many years, that an installation of the electric light on the Rogers system might be rendered somewhat less costly and less liable to derangement outside a laboratory or office, were the dividing boxes left out of the question.

We do, however, believe that Mr. Rogers has in action a very good incandescent lamp, but what claims are set forth in the patent for this we cannot say, as we believe the specification has not yet been published. In the schedule attached to the prospectus there are nine different patents, including the one we have just referred to for *division* and *subdivision*. As far as we are aware the patents for incandescent lamps, accumulating and storing electricity, and dynamo-electric machines, have only been applied for since the beginning of February of the present year ; it is, therefore, impossible for us to comment on five out of the remaining eight. That the public is prone to look upon anything for which a small sum is asked as worthless is well known, the price, however, required by the vendors of these patents, which, according to the prospectus, go to make up a complete system of electric lighting, is £40,000 in cash, 12,000 fully paid-up shares of £5 each, and 2,000 deferred shares of £5 each, the capital of the company being £510,000 in 100,000 preferred shares and 2,000 deferred shares of £5 each respectively. We may incidentally remark that, besides the patent of 1880 mentioned in the prospectus, there are now published the following specifications of Mr. Roger's electrical inventions : Nos. 1922, 4854, and 4855, this last having for its object the production of the *arc* and *incandescent* light in the *same lamp* and by the *same carbons* at will, so that the light may be changed from one to the other by a simple movement.

Seriously we do not desire to say anything respecting this company of a harsh nature, for it may be that Mr. Rogers really believes he has discovered actual improvements in electrical science ; but from what we have seen and heard for ourselves we could not in justice to electricians with *bonâ fide* inventions, or to the investing public, recommend a system of so-called division and subdivision concerning which the most ridiculous and misleading statements, it has ever been our lot to notice, have been noised abroad.

The second company to which we have called attention is apparently following the example set by the Fyfe-Main arc lamp promoters. Perhaps the result will be the same, but for the future gain of electric lighting we hope not, as so simple and inexpensive a lamp as the "Sun" deserves to make headway.

THE RED SEA CABLE.—We understand that Messrs. Siemens Brothers & Co. have chartered for the laying of that cable the ss. *Rochefort*, belonging to Messrs. John Cory & Co., of Cardiff. The *Rochefort* is a screw steamer, 220 ft. long by 31·2 ft. beam by 15·6 ft. deep, of 874 tons gross, and 99 horse-power. She is now moored off Messrs. Siemens works at Charlton, where she is being fitted with the necessary tanks, machinery, &c., for this kind of work.

INFLUENCE OF ELECTRIC CURRENTS UPON EACH OTHER.

WE think that very little information is ever to be found on this subject beyond that in certain text books, mostly belonging to a bygone age. As it is a question of considerable importance to electrical engineers, and as it can now be studied with much stronger currents than have heretofore been possible, we propose to occasionally devote a portion of our columns to the purpose of bringing the matter before electricians engaged in the practical work of electric lighting, believing that they may be able to materially augment our present knowledge by experiments of their own. The discovery made by Œrsted that *an electric current transmitted near to a magnetic needle deflected it from its normal position* excited throughout the scientific world the liveliest interest. New facts were experimentally sought for in order to prove the identity of electricity and magnetism, or to show that they were both only different examples of the same fundamental force. Electrical engineers now have opportunities for studying these effects in a

FIG. 1.

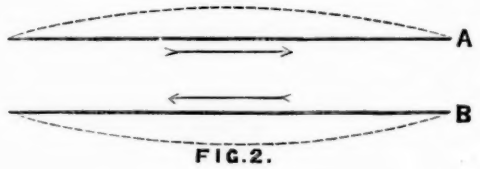
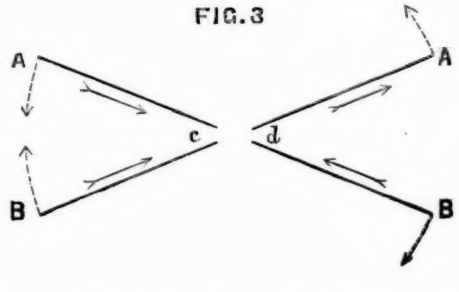


FIG. 2.

manner, and with means beyond anything available in the days of Œrsted and Ampère. It is well known that the latter philosopher found that the influence of electric currents on each other varied with position and direction, and the following is the fundamental law according to which these different influences act :—*Parallel currents attract each other when they flow in the same direction.* In fig. 1, A and B represent two conductors in which currents are flowing in the same direction, as indicated by the arrows. Were these conductors free to move in any direction, they would close up together, or if they were fixed at two points

FIG. 3



and free to move in the middle, the action, with a sufficiently powerful current, would be that shown by the dotted lines. The reverse action would take place in fig. 2, where the two currents are flowing in opposite directions, for in this case the two conductors would recede from each other, from the fact that *currents repel each other when flowing in opposite directions.* Following the fundamental experiment comes the influence of electric currents upon each other when not in parallel positions, for they then show a tendency to approach the same line and to fall into the same direction on that line.

If we take two currents, A *c*, B *c* (fig. 3), both flowing towards *c*, and forming whatever angle, the tendency will

be for the two conductors, from the example given in fig. 1, to approach each other, as shown by the dotted lines. This attraction would of course take place if the two currents were flowing from *c*, instead of towards it; repulsion takes place when one current is going in the direction *d* A, and the second in the opposite way, B *d*. We are feign to believe that now we are able to produce such powerful currents by means of dynamo-electric machines, some of our electrical engineers will devise a means of still further simplifying the lamps used in electric lighting by the aid of the attraction and repulsion of electric currents. At present we can call to mind but one practical application of this force, viz., the candle of M. Jamin. This well-known French *savant* took advantage of the fundamental law before mentioned to keep the electric arc at the tips of the parallel carbon pencils forming his candle; but some time before M. Jamin's invention, Mr. Robert Sabine had devised and taken out a provisional specification for electric lamps, in which the attraction and repulsion of currents were made, not only to keep the electric arc at the ends of two parallel rods of carbons, but these were also arranged in such a manner in connection with thick copper conductors, that the repellant force of the currents used was of sufficient strength to part the carbons automatically, and the distance between the carbons varied as the intensity of the current. We well remember assisting at the experimental trials of three different forms of electric lamps devised by Mr. Sabine and based on this principle, the results of which were at least encouraging, although the facilities for working at that time were not so great as at present. Perhaps another reason why these experiments were dropped was the fact that they were somewhat in advance of the times, there being little demand for, or encouragement to invention in electric lighting. We have brought the matter forward in the hope that it may suggest ideas to the many inventive minds now centred on perfecting this most useful of modern necessities.

MESSRS. SIEMENS AND HALSKE'S SELENIUM PHOTOMETER.

MEASURING instruments have always played an important part in electrical researches. The rapid progress of this new science, bringing into notice every day the discovery of phenomena hitherto unobserved, has in fact necessitated all throughout, methods of measurement better adapted to the nature and importance of the effects observed. Thus, these instruments were neither the least numerous nor the least interesting among the various models shown at the International Exhibition of Electricity. As marvels of invention, and the greater number at least as masterpieces of delicacy of construction, they justly ranked high in that great scientific and industrial display; but they derived their importance chiefly from the necessity of checking incessantly the results obtained, thus confirming one by the other the great laws which govern electrical phenomena throughout.

This apparatus, which is merely mentioned among M. J. Reynaud's notes, appended to his translation of Gordon's "Experimental Treatise on Electricity and Magnetism," is based on the variations of the electrical resistance of selenium under the influence of light. Among the very remarkable, but as yet illdefined, electrical properties of selenium, there is one which is known to everybody, viz., the diminution of its resistance under the influence of light. When subjected to different radiations, selenium does not seem to be influenced by the rays of heat, whereas the maximum of the effect produced upon its resistance seems to correspond to the maximum of light (between yellow and green). From this it follows that a comparison of the intensities of any two sources of light, based upon the variations of resistance in this substance, can only be exact when lights of the same colour are compared. This condition is expressly stated by the inventors of the selenium photometer, who have endeavoured to utilise this curious property as far as possible in the ingenious apparatus of which we are now going to give the description and the method of using.

DESCRIPTION.

The instrument consists essentially of two distinct parts: a galvonometer and the photometer properly so called.

Galvanometer.—The galvanometer is a Thomson portable galvanometer, G, fig. 1, with a single coil, in the middle of which a tube of copper, containing the mirror, slides easily. This mirror, concave in form, very light, and furnished with little magnets which distinguish it, is suspended in the tube by the top and bottom, by means of very short fibres; a little glass cap closes the tube in front of the mirror, and a screw placed at the back of the tube enables the mirror to be held fixed for packing or to be left free to swing; its oscillations can besides be slackened and thus the instrument is made into a dead beat galvanometer. A magnet, N, fig. 1, enables the influence of the terrestrial magnetism to be withdrawn, and thus the sensibility of the apparatus is made to vary.

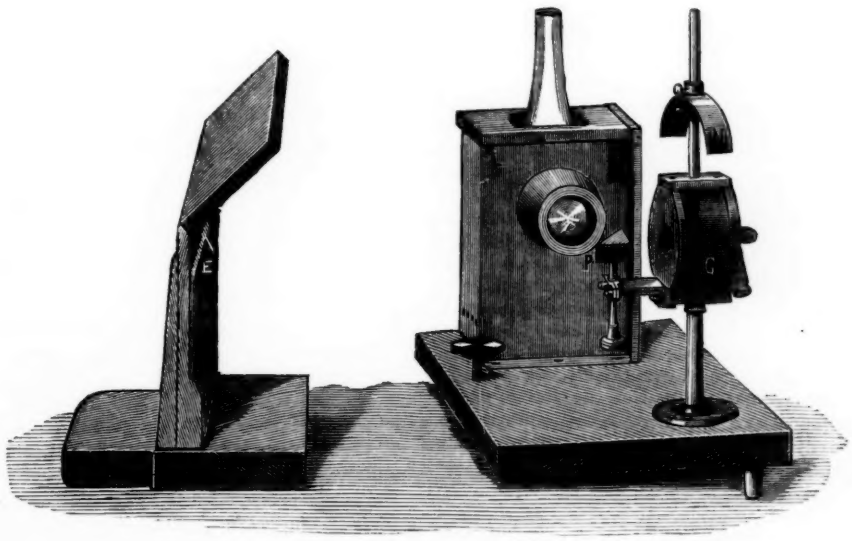


FIG. 1.

This galvanometer is mounted on the same stand as a petroleum lamp, L, protected by an inclosure of sheet iron. Opposite to an opening in front of the inclosure and with a

vertical cross wire between is placed a lens, which collects into a luminous sheaf the rays sent out by the lamp. The galvanometer and the lamp are arranged at right angles to one another on the stand. A prism, with total reflection, P, is placed over the galvanometer and supported by a stand which allows of it being adjusted to the position required. The luminous beam sent out by the lamp is received on the prism and sent back by it on to the mirror, which in its turn reflects it on to a divided scale, E, which is independent of the galvanometer and which can be drawn back or brought nearer at will in order to obtain clearness in the reflections.

In order that the prism with total reflection may not intercept the ray reflected by the mirror when the deviation is somewhat considerable, it must be placed a little lower than the mirror, and the reflecting surface must have the inclination required in order that the light reflected at first on the upper part of the prism may then fall on the mirror and pass on its return a little above the reflecting prism.

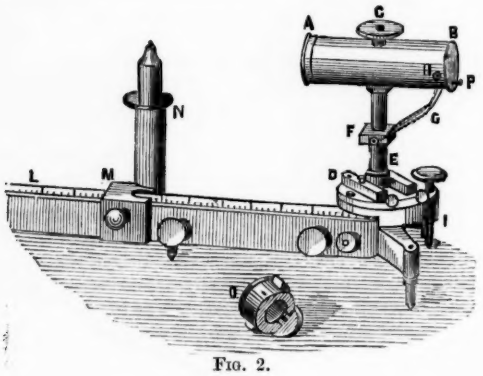


FIG. 2.

Photometer.—The photometer properly so called (fig. 2) consists of the selenium tube and of a graduated rule along which the luminous source taken as standard can move. The selenium tube is a tube of copper, A, B, 0^m. 03 in diameter and about 0^m. 15 long, blackened inside and mounted perpendicularly on a support movable round its vertical axis. This support is terminated at the bottom by a circular base, furnished with three horizontal branches with feet, which serve to keep firm the apparatus; of these three feet one, I, is screwed and allows of the position of the system being regulated.

On the circular base of the support are placed two horizontal terminals, D, E, insulated from the rest of the apparatus and only in communication with a circular metallic socket in the middle of which the support turns. In the latter is fixed a little plate of ebonite, F, with a metallic cincture, to which are fixed two contact springs, which insure electrical communication with the socket and the lower terminals in every position of the support.

The copper tube, A, B, open at both ends, can receive at one of its extremities, A, a metallic cap with a circular diaphragm, and at the other extremity, B, either a cap containing a screen with a cross wire, or the selenium box shown at O at the bottom of the diagram. This selenium box is made of horn and slides easily into the opening, B, of the cylinder. It contains the plate of prepared selenium sheltered from the light by a little slide, which is opened or closed at will on the apparatus by a little button shown at P. It is besides furnished with two little terminals, H, connected to the plate of selenium and insulated from the rest of the system; two insulated wires, G, coiled in a spiral, put these terminals, H, in contact with the two springs, and the lower terminals in all the positions of the tube, A, B, which is moved by the top button, C.

From this description it follows that a battery current arriving by one of the terminals, D or E, will pass through one of the contact springs, one of the wires, G, and one of the terminals, H, to the plate of selenium, and will return by the corresponding course to the other terminal, E or D, following, besides, all the movements of the tube, A, B.

On one of the horizontal branches of the tripod is fixed a scale, also horizontal, one metre in length, the zero of which is in the vertical plane passing through the selenium plate. Along this divided scale slides a runner, M, bearing the candlestick in which is placed the standard light. This light is maintained fixed at the height of the axis of the tube, A, B; its axis is in the vertical plane passing through the joint where the reading is taken, which allows its distance from the plate of selenium to be measured exactly.

We can, also, by means of the screw shown near I, in the foot of the apparatus, limit at will the course of the tube A, B, in the horizontal plane, and bring it without difficulty into such a position that the standard light may be in the prolongation of its axis.

MODE OF EMPLOYMENT.

Installation of the Galvanometer.—The scale is placed beyond the direct action of the lamp, and in such a manner that the middle of it may be about in the direction and at the height of the axis of the galvanometer, at a distance of at least 0^m. 5 from it (fig. 3).

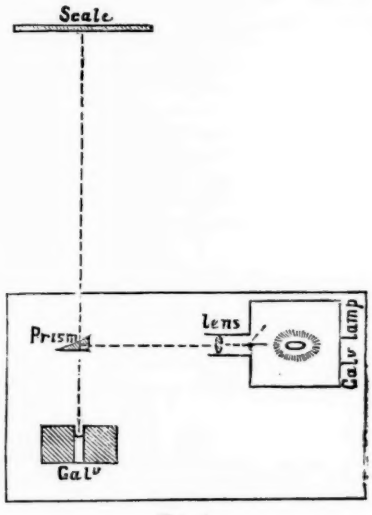


FIG. 3.

Into the coil of the galvanometer is introduced the copper tube containing the mirror with magnets, and it is adjusted in such a manner that the suspending fibres of the mirror which serve as an axis of oscillation may be about vertical.

The plane of the flattened flame of the petroleum lamp is made to coincide with that passing through the network and the centre of the lens (fig. 3). In order to arrive at it, we begin by taking away the prism appended to the galvanometer, so that the luminous ray of the lamp may fall freely on a sheet of white paper placed at a distance of one to three metres, so that by a suitable displacement of the lens a shadow of the wire may be obtained. The lamp is made to slide until the shadow of the wire no longer presents chromatic edges.

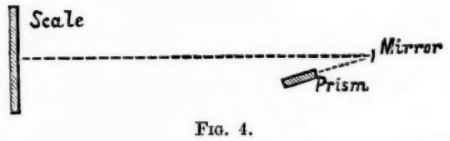


FIG. 4.

The prism is then replaced, and is turned until the reflected ray falls on the mirror with magnets, which is ascertained by looking directly at the mirror. The course of the reflected ray is then followed by the mirror, by means of a sheet of paper on which the ray is let to fall, and the prism is fixed in such a position that the light reflected by it falls in the middle of the mirror, and that the ray sent back by the latter passes back directly above the prism (fig. 4). By turning the screw, V, which is shown on the stand of the galvanometer (fig. 1), the ray is then brought to the height of the scale, and by causing the position of the directing magnet surmounting the galvanometer to vary,

it is made to arrive at any required division of the scale. Finally, the lens is made to slide until the shadow of the wire reflected on the lens is quite clear, and the tube of copper containing the mirror is turned until the shadow moves horizontally along the scale.

By raising or lowering the directing magnet, we increase or decrease at will the sensibility of the galvanometer, which can besides be arranged in any plane whatever.

In the lantern, for the objective in which the wire is stretched, we can substitute another, forming a diaphragm in which a vertical slit is made.

Employment of the Photometer.

The selenium photometer is adjusted in such a manner that the movable tube, when it is perpendicular to the scale, may be directed towards the luminous source, the intensity

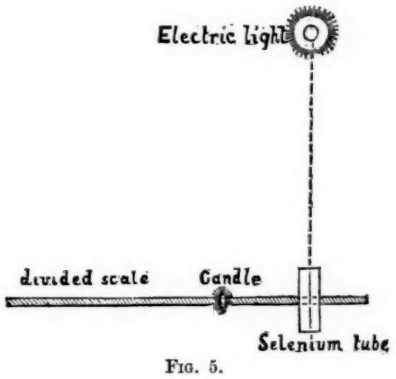


FIG. 5.

of which is to be measured (fig. 5). In order to arrive at this, the horn box containing the plate of selenium is taken away, and for it is substituted the socket, transparent at the bottom, with a cross wire, the front part of the tube being closed also by the diaphragm with the hole in the centre. The photometer is then turned in the direction of the luminous source until the shadow of the hole is projected on to the middle of the cross. Then the two abovenamed caps are taken away and the one at B is replaced by the selenium box.

These operations having been performed, we connect in one circuit the galvanometer, the plate of selenium, and a battery of 12 or 24 elements, which is filled with acidulated water, but not put into action until the moment for its employment.

As soon as the circuit is closed, a deviation of the galvanometer is observed, and the spot of light often goes off the scale; by adjusting the directing magnet, the reflection is brought back within the limits of the scale.

Under the action of the light, the resistance of the selenium decreases, and consequently the deviation of the galvanometer produced by the current increases. The plate of selenium is exposed to the light by the open portion of the tube which is turned towards the luminous source to be measured, and by the opening of the little valve of the selenium box adjusted at the other end of the tube.

We observe the deviation of the mirror corresponding to the resistance of the selenium influenced by the light; then, by causing the selenium tube to make exactly a quarter of a revolution—regulated by the screw, I (fig. 4)—it is directed towards the standard light, and the slide, M, is made to slide along the divided scale until the same deviation of the luminous point is obtained as before. By directing the selenium towards first one and then the other of the luminous sources, observing the corresponding deviations, and causing the distance of the standard light to vary along the rule, we find the distance at which the two sources of light produce the same effect on the selenium. These variations of resistance are very rapid. The distance of the plate of selenium from the light to be measured being known, and the luminous intensities being in inverse ratio to the squares of the distances, a simple reading of the divided scale enables the relative lighting power of the light studied to be deduced immediately. But, as we said at the commencement of this article, the selenium photometer is only strictly accurate when lights of the same colour are compared.

[This article was written for *La Lumière Electrique*, by M. E. Boistel, who is, we believe, the manager of Messrs. Siemens Brothers' establishment in Paris.]

THE SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.

ON the 11st inst., by the kind permission of Brigadier General Sir Evelyn Wood, V.C., G.C.M.G., K.C.B., commanding the Chatham District, and of the Commandant of the School of Military Engineering, Chatham, a reception was held at the latter place by Lieut.-Colonel Webber, R.E., the president of the above society. A large number of guests availed themselves of the invitation. After a luncheon at the Royal Engineers' officers' mess, a short lecture on torpedo warfare was delivered in the theatre by Major ARMSTRONG, R.E. The lecturer explained the various systems of torpedo defence at present in use. The firing of the fuses was either accomplished by low or high tension electricity. In order to make a clear distinction in the apparatus, that which was employed for low tension firing was coloured white; this included the various cases for holding the explosive materials. The apparatus, &c., for high tension firing was all coloured black. By this arrangement the various kinds of stores were not liable to become mixed up accidentally. The cases containing gun-cotton were partially painted red as a distinguishing mark. The nature of gun-cotton was explained by experiment, and it was shown that a form of the cotton which would only burn silently when ignited by the direct action of flame, could be exploded by a detonating fuse. The action of the "contact makers" in floating torpedoes was pointed out and practically illustrated. Major ARMSTRONG, in alluding to the exhibit by the War Department of torpedo apparatus at the Crystal Palace, said that the display might have been much greater if it had not been considered unadvisable to make too public many of the inventions devised.

The guests were next conducted over the schools of electricity, photography, chemistry, architecture, &c., and were also shown the various field operations, such as bridge and earthwork construction, the demolition of railway tracks, the firing of mines, both under water and under ground, the former especially producing a very magnificent effect.

The impression given was that the whole system of practical military instruction was very complete. It is, perhaps, needless to state that the whole party were much pleased with their visit, and with the extreme courtesy they received from the officers of the corps.

CORRESPONDENCE.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Correspondence should arrive not later than Tuesday morning if it is desired to appear in the following number.

FIRE RISKS FROM THE ELECTRIC LIGHT.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—Can you find room for the following sketch of the certain consequences attendant upon the carrying out of the wonderful sections 8 and 9 of the regulations for the prevention of fire risks arising from electric lighting? Of the other sections I can but express my astonishment that such an eminent assemblage of scientific men should have deliberated to so little purpose and produced nothing but commonplace

phrases. It is evident that not one practical man was asked for an opinion.

Scene, large jeweller's shop in Bond Street; time, afternoon in the month of November, a regular black fog outside, electric lights turned on (fitted up according to the 21st section of the regulations against risk by fire), and very much to the satisfaction of the proprietor, making him feel very safe. Enter lady, stylishly dressed. Shopman, bowing and rubbing his hands, either from custom or cold (the electric light doesn't give out any heat):

"What can I have the pleasure of showing you to-day, m'am?"

Lady: "I should like to see some diamond parures."

Shopman brings out some six cases of magnificent ornaments, and inwardly chuckles that the electric light has "fetched" this customer.

"Magnificent! unrivalled!—worth 4,000 guineas; the Duchess of S—— can't match them."

Sections 8 and 9 take effect. The shopman hears the rustling of a dress, the creaking of a door. The consequences flash across his mind and he rushes round the counter, over a judiciously-placed chair, with his proboscis against a plate-glass case. With the shock the five words—"D— the rules and regulations!"—are jerked out of him. £10,000 are gone! Electric light companies are at a discount, and dear old Gas taken into favour again.

The committee must have slept the last four years. What has been the aim of all electricians? To make the light reliable, and here are rules, framed by clever men, to make what has been accomplished nugatory.

Your leader is sensible and in the right direction; it is a pity the committee couldn't have it before their eyes; we should then have been spared such a poor exhibition.

I remain, Sirs,
Yours obediently,
E. A. PARIS.

Shepherd's Bush, W., *July 8th*, 1882.

A NEW USE FOR INCANDESCENT LAMPS.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—It is a well-known fact that in many countries night fishermen use lights to attract the fish towards the nets or other appliances for catching them. To carry this idea out to perfection, our fishermen must have an incandescent lamp (supplied from an accumulator carried in their boats), attached to the nets as they cast them into the water. It is a very common occurrence for one of our fishing boats in Scotland to catch in a single night herrings to the value of one hundred pounds, and I think I am correct in saying that a special committee appointed lately to inquire into fishery matters, agreed from evidence that there were as many fish in the sea now as in the days of our forefathers, so that there seems to be no fear of the supply running short. Would it not, therefore, be wise for some enterprising individual or company to make experiments in this line?

Speaking from some knowledge of both subjects, I believe the idea to be a perfectly practicable one.

I am, yours faithfully,
DENSHIN.

ELECTRIC LIGHTING FOR STREETS.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—Touching remarks by Col. Haywood on the lighting of the Holborn Viaduct by the Edison Incandescent Light, I would observe that I presume the Colonel likes the lighting because it is very "gas-like," save that the latter has the advantage. I consider the Viaduct far better lighted by gas than by the small electric lamp. The spoiling of walls and furniture does not here apply, and the two being nearly equal in illuminating power, gas is decidedly the best for the purpose; but in the matter of street lighting, we want more light—very much more light. Same applies to railway stations; and I may here mention that since the District Railway at Charing Cross has been lighted by electricity no accidents have occurred; prior to such they were not unfrequent—I allude to passengers stumbling in getting in and out of the train for want of sufficient light.

Over near three years ago the Holborn Viaduct was lighted by the Jablochkoff system. Col. Haywood then pronounced it beautiful, but too expensive. At *that* date it cost 6½d. per light per hour: same price was charged the Metropolitan Board of Works for the Embankment. Excessive cost caused the City authorities to discontinue the light; the Board continued, and, by a gradual reduction, have now arrived at 1½d. per light per hour for a lamp giving 380 candle-power. The street lamp gas-lighted costs ¼d. per hour for 10 candle-power. The calculation is easy.

If the Holborn Viaduct is to be lighted by electricity let it be by an arc lamp, by which much more light will be afforded; not by an electric light which in every feature as nearly as possible resembles gas. We live in an age of improvement, and desire to be further enlightened. By all means let us have Sugg's grand burner, if not too expensive; but do not attempt to light great thoroughfares by an electric lamp which in candle-power is not superior to the ordinary gas-lamp of the past decade.

ELECTRON.

July 11th, 1882.

DOLBEAR TELEPHONE: A CRITICISM CRITICISED.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—In a recent number of this journal (June 24th) an article appeared from *La Lumière Electrique*, in which Count du Moncel takes occasion to criticise a paper read March 23rd, 1882, by Prof. A. E. Dolbear, before the Society of Telegraph Engineers.

Prof. Silvanus Thompson has, in the 1st July issue, very ably responded to a part of the statements made by the Count du Moncel, viz., that part relating to the early history of the Reiss telephone. There are also other statements of the Count which it does not seem desirable to have remain unchallenged.

In conclusion he says:—"But I think it is as well to remark that 'Mr.' Dolbear, in calling his apparatus a novelty is in error. In the first place, the production of sounds by a condenser was not new, inasmuch as Mr. Dolbear himself, in his historical account, alludes to it, and what would be new would be the possibility of reproducing speech in this way; but it is Mr. Herz who obtained this result first, at the commencement of the year 1880."

The fact that sounds may be produced by a condenser having been widely known for so long a time, it seems strange that a writer upon scientific subjects should think it necessary to state that the idea is not a new one. As the writer understands the claims of Prof. Dolbear they are as follows:—(*a.*) The first to conceive the possibility of reproducing speech by means of condensers. (*b.*) First to accomplish it by experiments. (*c.*) First to produce a practical speaking telephone founded upon those principles. These claims are still maintained.

In reply to this the Count says, "But it is Mr. Herz who obtained this result (the reproduction of speech) first, *at the commencement of the year* 1880."

This remarkable statement assumes, 1st, that its author is well aware of the time when Prof. Dolbear first accomplished this; and, 2nd, that it was done at a date subsequent to the one above mentioned.

As a matter of fact the Count du Moncel knows nothing of the kind; nor has he ever had any adequate means of knowing.

It behoves the noble Count to be more cautious how he indulges in such unguarded statements. The "impartial historian" does not assume facts and draw conclusions therefrom which suit his own convenience, nor will *such* conclusions ever receive the title of "*legal perorations*."

Granting that the experiments attributed to Mr. Herz were made, as stated, as early as the commencement of the year 1880, the work was not new.

The Dolbear condenser telephone dates are prior to that; indeed the instrument was even then in almost, if not quite, its present perfected shape.

Very many persons had admired its clear and perfect enunciation.

Business men had become interested in it previous to this time and had embarked in the enterprise of bringing it

into public use. Precautions were taken to have ample proof of all this, with signatures and dates upon apparatus with properly certified affidavits, &c., &c.

For the present, for reasons which already appear to have been good and sufficient ones, those dates are withheld. But all the evidence and much more will at the proper time and place be produced. We all know how easy it is to have some abandoned experiment or vague idea recalled by the ultimate success of that idea. To illustrate :—

The Count says—"On June 2nd, 1875, Mr. Bell had thought of this substitution (permanent magnet for electro-magnet), and if this *savant* had not put this into practice in the apparatus exhibited by him at Philadelphia, in June, 1876, it is because he expected to obtain more powerful effects by a system in which the magnetic organisation was formed by an electro-magnet (strongly magnetised by a continuous current) than by a system formed by a simple permanent magnet of steel." Granting, for the time, that Mr. Bell did in June, 1875, conceive the idea that he could use a permanent magnet *in place of a battery*, that idea was, after deliberate reasoning, abandoned by its author as worthless.

This *lost idea* added nothing to the sum of human wisdom. It might as well never have been—indeed better ; because it leads to a fixed erroneous opinion. Such opinions, like false theories and formulæ in science, are only productive of evil.

In order that Mr. Bell might recover this idea, one of two things must first happen. Its truth must be forced upon him by accident during his experiments or, having obtained a more complete knowledge of his subject, he must, with the new data, reconstruct his previous opinions. It is generally admitted that abandoned experiments are to be disregarded, because of no use to any one. How much more so an abandoned idea which its author discards. One is reminded of the drowning man and the straw when such claims are woven into what purports to be an historical fabric.

As the second earliest experimenter in this unique line of discovery, Count du Moncel brings forward Mr. Dunand in the following words—"Mr. Dunand, of whom Mr. Dolbear was so careful to speak, in the month of September of the same year, obtained very important results in consequence of principles precisely contrary to those laid down by Mr. Dolbear. Thus, by means of eleven small condensers, formed of sheets of paper of small dimensions and very numerous, joined up in quantity and arranged fan fashion, he succeeded in transmitting speech sufficiently powerfully to be heard at a distance of two or three metres from the instrument. It is true that he employed two batteries, one of which, that destined to polarise the plates, was very powerful ; but these experiments show that the theoretical ideas of Mr. Dolbear cannot be accepted without great reserve."

It is not worth while at the present time to discuss the *molecular* and *mass motion* theories for explaining the action of telephonic diaphragms ; however, notwithstanding the Count has for years diligently advocated the former, very many, and probably the majority of eminent physicists believe the latter to be the true explanation.

Another of Prof. Dolbear's *theoretical ideas* is as follows:—"In my opinion the greater the number (of plates) employed the less effective will be the telephone of this kind."

That opinion was the result of long series of experiments many times repeated, and under all conceivable conditions. The Count states, as something astonishing, that speech could be heard *two* or *three metres*, although he admits that the apparatus was somewhat elaborate. Prof. Dolbear says, in that very communication, that he has been enabled to hear speech at a distance of 50 ft. The writer can assure the readers of this journal that the Professor's statement was far within bounds, as could be testified by hundreds who have heard it at that distance. Doubtless Mr. Dunand has done some excellent work in this line ; but it is yet to be shown that he is a pioneer in the business.

In referring to the practical use of any telephonic system, even at the present day, Prof. Dolbear took occasion to say that it is necessary to inclose the instrument in a case in order that the air waves might be concentrated upon the ear. Touching upon this point, the Count feels "obliged to say to 'Mr.' Dolbear that there exist telephonic receivers which are susceptible of being heard at a distance !" To one familiar with the immense number of experiments which Prof. Dolbear has performed in this line, with all kinds of, and systems of, apparatus, and in the light of the astonishing results which he has obtained the statement which Count du Moncel feels obliged to make to "Mr." Dolbear is ludicrous in the extreme.

By the way, why is it that the eminent Count, who is generally so courteous, fails to give him his usual title ? Prof. Dolbear has for many years occupied a professor's chair in the highest educational institutions in America.

If Count du Moncel will write with a fair and unbiassed pen, the eminent men belonging to the Society of Electrical Engineers, many of whom have ever shown the liveliest interest in original scientific work from every source, will, doubtless, be only too willing to have him eradicate that "complete ignorance" of the host of distinguished *savants* who have occupied themselves in the question of the telephone.

I trust the time will come when Count du Moncel will not display either a "real or voluntary" forgetfulness of the just claims of any one.

HENRY C. BUCK.

NOTES.

TELEPHONE EXCHANGE CALL SYSTEM.—Through the courtesy of Mr. G. Edward Smith, of Boston, Mass., United States of America, we are enabled to give a full description (see p. 24) of a telephone exchange call system, the invention of Mr. Kettell, of Worcester, Mass., U.S.A., which enables a number of subscribers to be put in communication with a central exchange by means of one wire only. The apparatus is considerably in advance of anything of the kind yet brought out, and as we have had an opportunity of seeing it actually in action, we can testify that it can do all that is claimed for it. In view of the extending use of the telephone, the apparatus of Mr. Kettell is one worthy of consideration. As a rule, the number of subscribers that can safely be placed on one circuit is about eight ; that is, with the mechanisms of the apparatus arranged so that the wheels, w and w_1, revolve once in a minute. Now, the angles at which the contact arms on the wheel, w, make contact with the spring, s, differ only by a few degrees in each instrument, and as it is important that the contact arms in one instrument be quite clear of the spring, s, before the corresponding arm in the next instrument makes contact in its turn with its own spring, there is a danger of the contact being made in one instrument before contact is broken in the previous one if the angles are made too small ; consequently it is not advisable to have too many contacts. If the angles are increased, then the time occupied by the clock-work in passing through the whole series of contacts will be proportionally lengthened, which would cause a delay which is unadvisable. With eight subscribers the clock-work need not run longer than one-third of a minute, and it is not advisable to exceed this time, except in special cases.

If time is of no consequence, there is, of course, almost no limit to the number of subscribers that can be looped on one circuit.

In conclusion, we would state that the invention of Mr. Kettell is certainly the most satisfactory solution of the problem in question which has yet been brought out, and the fact of its being practically used, and with perfect success, is a sufficient proof of its value.

THE TELEPHONE.—We read in the *Electrician* of New York that on the evening of Friday, June 23rd, Professor Dolbear lectured on "The Developments of the Telephone" before the Electrical Society of New York. When in Europe the Professor met the assistant of Reiss, who said that, as a matter of fact, the Reiss telephone actually did transmit words and sentences.

TELEPHONES.—Under this heading the following notice has appeared in several of the Scottish daily newspapers :—"The Bell Telephones supplied by us to various persons in

Scotland were purchased from the owners of the Bell patents, and the holders of them are requested to disregard the circulars and other communications received from the United Telephone Company (Limited), and to communicate with us—Messrs. Tasker Sons and Company, Sheffield."

THE INDUCTOPHONE.—A letter by C. O. Mailloux appears in the July number of the *Electrician* of New York on the above subject, in which the writer refers to a particular experiment made by him in July and August last, when making observations on the induction balance, which experiment led him to notice all that Mr. Willoughby Smith has recently described.

CANDLE POWER OF ELECTRIC LAMPS.—It would be well to remember in the future that the 2,000 candle power Brush lamp, as employed in the City lighting, is stated to give that amount of light when *naked*, but as covered with a globe this light is reduced 50 per cent., or to 1,000 candles. The Weston lamp, for the same purpose, is stated to give 1,600 candle power naked, and about 1,000 when enclosed, the globe only reducing the light from 30 to 40 per cent. The smaller Siemens lamps, which were stated to give 300 candle-power each, must be understood to mean when enclosed in their globes.

STREET ACCIDENT FROM ELECTRIC LIGHTING.—We notice in the *Times* of the 8th inst. and also in the Brighton papers an account of a peculiar accident which took place at the above town on the evening of the 7th inst. While the members of the local Volunteer Fire Brigade were proceeding up North Road with their fire-escape it came in contact with the electric light wire overhead, and the electric fluid descending the wirework of the escape caused those Volunteers who had control to loose their hold. Another member, thinking the machine was falling, grasped the steering rod, and received the full force of the electricity, which was so powerful as to bend him double, and disable him for upwards of an hour. We are under the impression that the system of electric lighting employed where this accident occurred is that of the "Brush."

ELECTRIC LAMPS FOR LARGE SPACES.—During the earlier stages of the City experiments with the Siemens' large lights they were kept at an altitude of 70 feet above the road and the light enclosed in a globe of clear glass. It was afterwards found that a more advantageous effect was produced by reducing the height above ground to 40 feet and employing opal globes for the lamps.

THE EDISON ELECTRIC LIGHT.—The City Engineer thus speaks of Edison's light in his report to the Commissioners of Sewers :—

"The Holborn Viaduct is at the present time lighted experimentally by the Edison Company, who have placed two incandescent lamps in each gas lantern, each lamp, as stated by the company, giving about the same light as an ordinary gas lamp, and the two, therefore, double the light of the gas lamp disused. No lamp is more than 66 feet distant from another. There is scarcely any part of the Viaduct which is better lighted than another; there are no strong shadows to deceive the eye and the footstep; there is no flickering and no material variation in illuminating power, so far as can be noticed by the ordinary observer, and the Viaduct is, for all practical purposes, well lighted.

"This Edison experiment will, when terminated, be specially reported on, and is only referred to here to assist in the consideration of the advantages derivable from the great volume of light given by the arc light compared with that given by the ordinary gas lighting, the incandescent lamps on the Viaduct being arranged on the same principle as the gas lighting, and aiming at uniform distribution of light over the public ways."

THE JEWS AND THE ELECTRIC LIGHT.—A singular difficulty has arisen in regard to Jewish speculation in the electric light. It is asserted that as no orthodox Hebrew will touch fire or light on the Sabbath (a circumstance not generally known), the *Jewish Chronicle* has been asked to decide whether the electric light is unlawful. The editor apparently found himself on the horns of a dilemma, for all he could say was, no orthodox Jewish minister would be prepared to answer the question. If this be so, it may well be presumed that the financial Jew will feel at liberty to use his own discretion.

THE ELECTRIC LIGHT AT LIVERPOOL.—We understand that the Pilsen and Joel Company are now placing the Pilsen arc lamp in Mr. W. Lea's music and pianoforte warehouse at Liverpool.

THE PILSEN ARC LAMP.—We understand that the Pilsen lamps recently fitted up in Messrs. Baker's premises, High Holborn, and also at Messrs. Crisps, of Holloway, are now to be seen nightly in operation.

ELECTRICAL ACCUMULATORS.—We hear that the Hammond Electric Light and Power Supply Company has acquired the right to manufacture and sell Donnithorne's accumulators for the United Kingdom, and that the "Pilsen"-"Joel" Company has also acquired the right to purchase a secondary battery patented by Woodley and Joel.

TELEGRAPHIC INTERRUPTION WITH ALEXANDRIA.—The Eastern Telegraph Company announced on Monday last that their cable ship *Chiltern* had put to sea from Alexandria to pick up the cable, and that all commercial telegrams with Alexandria were stopped. A later telegram, received by the company from their steamer *Chiltern*, stated that she was in communication with Malta and Cyprus, acting under Admiral Seymour's orders.

The Eastern Company have arranged to place a floating station off Suez to keep up communication during hostilities.

THE EASTERN TELEGRAPH COMPANY.—We observe in the *Standard* of last Wednesday the following interesting notes concerning the above company's work at Alexandria. The English public has much reason to be indebted to the Eastern Telegraph Company for the admirable manner in which, under circumstances of the greatest difficulty, the telegraphic service between Alexandria and London has been maintained. It deserves to be mentioned that the telegram which we published in our second edition yesterday morning, announcing the commencement of the bombardment, was despatched from her Majesty's ship *Invincible* at forty minutes past seven a.m., and was received in London at five minutes past six a.m. (the difference in the time between Alexandria and London being as nearly as may be two hours), so that the message reached this office within about thirty-five minutes from the time it was despatched from Alexandria. The verbal accuracy, too, with which the messages are transmitted deserves the highest praise.

At present the Eastern Telegraph Company's ship is moored about four miles from Alexandria, and has on board the cables by which she can communicate with Malta and Cyprus. The land lines in Egypt are now cut, and the Company has moored a large lighter, with their staff on board, three miles from the shore at Suez, from where they can telegraph to Aden and Bombay. Telegrams are coming from Suez round by Bombay and the Indo-European line through Persia, and going round back to the Company's floating station at Alexandria.

An interesting telephonic experiment was tried yesterday at Malta, during the bombardment of the forts at Alexandria. A telephone was attached at Malta to the Alexandria cable, and connection was made with the other end of the cable on board the *Chiltern*, off Alexandria. It was found that, owing either to the distance, or to the vibration caused by the firing, it was impracticable to send a verbal message, but the firing at Alexandria was distinctly heard, through the telephone, at Malta—a distance of more than a thousand miles.

PROTECTING THE TELEGRAPH SHIP "CHILTERN."—After the bombardment of Tuesday, Admiral Sir Beauchamp Seymour, considering the position of the *Chiltern* not altogether secure, gave orders for a vessel to cruise round her for her protection.

THE MULL TELEGRAPH CABLE.—A great deal of inconvenience having been experienced in the island of Mull, owing to the telegraph cable between the mainland and the island being broken, strong representations were made to the Postmaster-General. These representations have not been in vain, as Mr. Fawcett, replying to Lord Colin Campbell, under date July 5th, says :—"I am happy to tell you that the Department has secured the services of a ship to effect repairs to the Mull cable, and that the vessel will be despatched in a few days."

THE AMALGAMATION OF THE ENTIRE TELEGRAPHIC SYSTEM OF CANADA LEGALISED.—From the New York *Journal of the Telegraph* we observe that in the Senate of Canada, at Ottawa, on May 4th, the Act recently passed by the House of Commons legalising the amalgamation of the entire telegraphic system of the Dominion, under the charter of the Great North-Western Telegraph Company, of which Mr. Erastus Wiman, of New York, is president, was passed by a vote of 35 to 11. This consolidation was consummated some time ago, under the auspices of the Western Union Company, which by the privileges now granted to its annex, the Great North-Western Telegraph Company, has secured several substantial and important advantages. The rate in Canada for the past two years under competition has been twenty cents for ten words, irrespective of distance. But this rate has been successfully advanced 20 per cent. to twenty-five cents, and is now legalised in such a manner as to make it almost absolutely permanent. An attempt to make it otherwise, should the profits be exorbitant, was proposed in an amendment, of which the following was the concluding sentence :—"No Act of Parliament reducing the maximum rate herein provided shall be deemed an infringement of the privileges granted by this Act." This amendment was voted down by a large majority, all the members of the Government voting against it, Parliament thus practically affirming the arrangement made with the combined telegraph companies. An amendment to make the rate twenty cents for ten words received an emphatic quietus of 99 to 48, so that in every way the Commons indicated a disposition to give the contracting companies a sufficiently remunerative rate not only to do the work well but also to make some money.

NEW ATLANTIC CABLES.—We hear that the prospectuses are ready for issue of a new company, which is to lay two cables across the Atlantic. These cables are to be manufactured by the Henley's Telegraph Works Company, and when laid the contemplated tariff is to be 9d. per word.

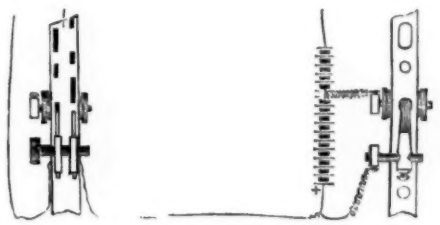
With two fresh cables by the above company, and two, as mentioned last week, to be made and put down by the India-rubber Company, tariffs between England and America should in the future rule low.

CENTRAL AND SOUTH AMERICAN TELEGRAPH COMPANY. —Panama, June 8th.—The W. T. and P. S. S. Company's steamer *Bolivar* brought a number of young men for the service of the Central and South American Telegraph Company on the coast. They are Messrs. Tracey, Pascod, Turner, Harding, Coxen, Cranwell, Rowe, Cooke, Tiddy, Davey, Hoskings, MacLachlan, Barnes, Field, Atherton, and Brain. To only a few of these have stations been assigned, and on the arrival of the *Silvertown*, which may be expected here some time in the present week, Mr. J. B. Stearns, the general manager, now on board that vessel, will arrange the distribution of those now here where the necessities of the service may require. Another contingent sailed from Liverpool by the ss. *Cuban* on the 25th ult., on the arrival of which a distribution of officers, electricians, assistants, &c., will be made from Lima to Tehuantepec. A Mr. Murphy, we are informed, will be the resident agent of the Company in this city, and to Mr. Stanley McNider, now in Guatemala, will be confided the superintendence of the line from this place to Tehuantepec. Per ss. *Dacia* and ss. *Silvertown* the following members of the Central and South American Telegraph Company's staff arrived on the coast :—Messrs. W. Kelly, J. Milne, W. Clarkson, H. F. Horan, M. Murphy, and Charles G. Murphy.

TELEGRAPH STEAMER "INTERNATIONAL."—Since the completion of the Mexican cable extension to Galveston, the ss. *International* has been chartered by the International Ocean Telegraph Company, of New York, to repair one of the Key West-Havana cables, belonging to that company. The India-Rubber, Gutta-Percha, and Telegraph Works Company received on the 4th inst. a telegram from Mr. Theophilus Smith, engineer-in-charge, announcing the safe arrival there on that day of the *International*. All well on board. The *International* will start at once, with these repairs.

AUTOMATIC TELEGRAPH.—Patent No. 259,226, filed in the United States of America Patent Office, November 8th, 1881, by Gerritt Smith :—

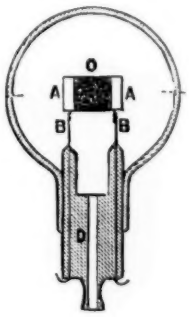
Brief.—When a perforation of the transmitting-strip is under the brush the larger battery is short-circuited, and a record is made at the receiving-station by the right-hand pen. When this short circuit is broken the larger battery overpowers the smaller, and a record is made on the other pen. Any polarised receiving-instrument may be substituted for the pen.



Claim.—The combination, substantially as hereinbefore set forth, of a pattern-strip having a single line of perforations, a circuit-closer brought into action by each perforation in said line in succession, two transmitting-batteries of unequal and contrary electromotive forces, and a receiving-instrument which responds to the action of currents of alternative polarity.

THE ELECTRIC LIGHTING BILL.—It is said that an effort will be made to carry the Electric Lighting Bill through Parliament before the adjournment.

ELECTRIC LAMP.—Patent No. 259,062, filed in the United States of America Patent Office, February 11th, 1882, by Charles J. van Depoele :—



Claim.—1. In an electric lamp, the combination with a confining-globe, a holding device, and conducting-wires, of a non-conducting medium connected with the wires, and provided upon its surface with small particles of finely-divided conducting medium secured close together, but not in electrical contact, substantially as described.

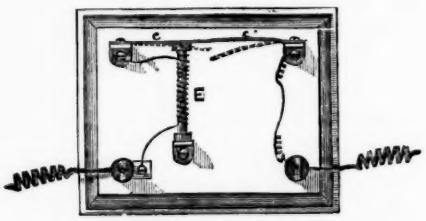
2. In an electric lamp, and in combination with the terminals, A, A, conductors, B, B, a confining globe, and a suitable support, the non-conducting medium, O, provided with small particles of carbon not in electrical contact, substantially as described.

3. In an electric lamp, the combination, with a non-conducting medium provided superficially with small particles of finely-divided conducting material not in electrical contact, of a glass globe enclosing said conducting and non-conducting mediums, and from which the air has been abstracted and replaced by some non-supporting gas, and suitable electrical connections leading from the mediums within the globe, substantially as described.

SAFETY DEVICE FOR ELECTRIC CIRCUITS. — Patent No. 259,616. Filed in the United States of America Patent Office, January 5th, 1882, by Edward Weston.

Brief.—When the paraffin, E, melts from the heat of the resistance it allows the springs, *c* and *c'*, to separate and break the circuit before damage is done to the instruments in line.

Claim.—1, The combination, with an electric circuit, of a wire or similar conducting medium of higher relative resistance than the conductors with which it is connected, a circuit interrupter, and a mass of fusible material surrounded by or in proximity to the wire of high resistance, and arranged to maintain the continuity of the circuit through the interrupter until softened by heat.



2 In a safety device for electric circuits, the combination, with a circuit interrupter, of a mass of highly fusible material for preventing the same from acting, and a resistance wire included in the circuit with the interrupter, and in proximity to the fusible material, substantially as set forth.

3. In a safety device for electric circuits, the combination of springs, *c*, *c'*, a mass of fusible material for maintaining the same in contact, and a resistance wire surrounding the fusible material, for the purpose set forth.

4. The rod, E, or its equivalent, composed of a non-conducting substance, which softens at a low temperature, and powdered metal for rendering the same a better conductor of heat.

THE INSTITUTION OF CIVIL ENGINEERS.—The Council of the Institution of Civil Engineers, London, have awarded to Mr. Alan Brebner, junior, B. Sc., University of Edinburgh, the Miller Scholarship of £40 yearly for three years, for a paper on "New Forms of Dioptric Apparatus for Electric and other Flashing Lights."

NOTES ON THE LAW AND PRACTICE RELATING TO LETTERS PATENT FOR INVENTIONS.—Our readers will doubtless remember that we published a short time since in the ELECTRICAL REVIEW a series of articles on the above subject by Mr. T. J. Handford. These have now been reprinted by that gentleman with alterations and additions, and the complete pamphlet may now be obtained at his office, 42, Southampton Buildings, Chancery Lane.

ELECTRICAL PATENTS.—During the half year from July to December, 1881, 394 electrical patents were taken out in the United States of America Patent Office. Of these forty-eight are credited to T. A. Edison, and are mostly assigned to the Edison Electric Light Company of New York.

ANOTHER APPLICATION OF ELECTRICITY.—A new electrical instrument, devised by Captain M'Evoy, is likely to be of considerable value in submarine operations, such as searching for torpedoes, sunken vessels, lost anchors, &c., and it may be that submarine telegraph cable work may be aided by its employment. The invention is based on the induction balance of Professor Hughes. The instrument is so arranged that when let down by means of a cable to the bottom of the ocean, the operator, who is listening to a telephone, hears a loud noise when the case containing the apparatus is brought within the influence of the submerged metallic body.

ACCIDENT TO A TELEGRAPH LINEMAN. — A lineman named Thomas Gowrie, in the employment of the North British Railway Company, met with an accident on Saturday last, while repairing a wire at Abbeyhill Station, Edinburgh. When Gowrie was on the top of a pole it broke at the bottom, causing him to fall to the ground, whereby he sustained a fracture of the right thigh.

NEW COMPANY REGISTERED.

J. B. ROGERS ELECTRIC LIGHT AND POWER COMPANY (LIMITED).—Capital, £510,000, divided into 100,000 A or 10 per cent. cumulative preference shares and 2,000 B or deferred shares of £5 each. Objects: To purchase the letters patent of Mr. John Banting Rogers, electrical engineer, of 47, Holborn Viaduct. The consideration is £20,000 cash, the 2,000 deferred shares and 12,000 preferred shares, such shares to be considered as fully paid up. The plant, stock-in-trade, and other business property of the vendor will be purchased by the company for £20,000. Signatories: J. T. Lovering, 77, Gresham Street, 1,000 shares; W. G. Rawlinson, 134, Cheapside, 100 shares; T. F. Brooke, 157, Richmond Road, Hackney, 20 shares; T. E. Nicholson, Highgate, 40 shares; C. W. Harris, 14, Golden Lane, 20 shares; J. J. Molyneux, Downs Park Road, Hackney, 20 shares; J. Chapman, 1, Gresham Buildings, 20 shares; B. Newstead, 100, Buckingham Road, Southgate Road, 20 shares; Henry Moore, 59, Bishopsgate Street Within, 100 shares. The signatories elect the first directors; remuneration, £2,000 per annum. Registered 5th inst. by West, King & Adams, 66, Cannon Street.

CITY NOTES.

OLD BROAD STREET.

THE EASTERN TELEGRAPH COMPANY (LIMITED).

THE report states that the company's revenue for the six months ended 31st March, 1882, amounted to £321,810 13s. 5d., from which are deducted £75,140 19s. 5d. for the ordinary expenses and £40,269 13s. 2d. for expenditure relating to repairs of cables during the half-year. After providing £2,585 1s. 4d. for income tax, there remains a balance of £203,814 19s. 6d., to which is added £29,504 9s. 6d. brought from the preceding half-year, making a total of £233,309 1s. From this amount there is deducted £22,726 9s. 2d. for interest on debentures; £20,559 1s. 3d. for dividend to 31st March, 1882, on the preference shares; and £75,000 placed to the general reserve fund; leaving a balance of £115,033 18s. 7d. The directors have, during the half-year, paid an interim dividend of 1¼ per cent. on the ordinary shares for the quarter ending December, 1881. They now recommend the declaration of a final dividend for the year ended 31st March, 1882, of 2s. 6d. per share, and a bonus of 1s. per share, both payable on the 14th instant, making, with the three previous payments on account, a total distribution for the year of 5¼ per cent. on the ordinary shares. The balance of £1,033 18s. 7d., shown at the foot of the revenue account, is proposed to be carried forward to the next half-year. The general reserve fund, after adding the interest received during the half-year, now amounts to £443,535 1s. 7d.; this, with the special reserves stated on the balance sheet, makes the total amount of reserves £490,816 14s. 6d. The revenue includes £19,500 received for the half-year upon the company's shares in the Eastern and South African Telegraph Company. The reserve funds of that company now amount to £118,695 0s. 11d., and, in addition, the sum of £37,537 10s. is held by the trustees of the sinking fund for redemption of debentures. The revenue account also includes £2,600 dividend for the half-year on the shares of the Black Sea Telegraph Company, belonging to this company, by which the line is worked and maintained under agreement.

The various sections of the company's cables are in good working order, with the exception of the direct Lisbon line and the 1870 Aden-Bombay cable. The Lisbon end of the direct cable has been recovered and buoyed, but the operations of the company's ships on the northern end of the line have been delayed owing to the continuance of very rough weather. The repairs to the Aden-Bombay cable have been deferred during the prevalence of the south-west monsoon. Owing to the disturbed state of affairs in Egypt the directors, acting in accord with Her Majesty's Government, have made arrangements to secure telegraphic communication with the fleet at Alexandria in case the connection with the shore should be interrupted. The ss. *Chiltern* has been brought from her station in the Red Sea to Alexandria, and is now there in readiness for further requirements.

A concession has been granted by the Emperor of Austria for the laying of a submarine telegraph cable between Trieste and Corfu. The cable has recently been laid by the Telegraph Construction and Maintenance Company, thus placing Austria, Hungary, and the central part of Europe in direct submarine telegraphic communication with this company's cables in the Mediterranean and Levant. The concession is exclusive for twenty years, and entitles the holders preferentially to the transmission of all official messages and to all private messages not specially directed to be sent by another route. As stated at the last ordinary general meeting, the Board have made arrangements for taking over the line and concession, and a resolution will be submitted to the extraordinary meeting empowering the directors to do so at a price not exceeding £67,000.

The directors have concluded an arrangement with the Turkish Government for the re-establishment of the connection, by telegraph cable, between Malta and the Regency of Tripoli, a distance of 220 miles. The cost will be about £25,000. A resolution will be submitted to the extraordinary meeting approving the arrangement.

On Thursday last the twentieth half-yearly general meeting of the above company was held in the City Terminus Hotel, Cannon Street, John Pender, Esq., M.P., chairman of the company, presiding. There was a large attendance of shareholders.

The Secretary, Mr. George Draper, having read the notice convening the meeting, and the minutes of last meeting having likewise been read and approved, the report was taken as read, after which,

The Chairman said that he should as usual refer to some items in the report, so that they might have a more correct idea of the working of their system during the past six months. Various items of the report were then gone over in detail. He was sorry, he said, that

during the year such a large sum had been necessarily spent for repairs to cables. That expenditure had amounted to £40,269, as against £29,942 for the previous year. He could hardly think that much exception could be taken to expenditure which was preserving their system in such a thoroughly efficient state. The increase of expenditure on salaries and wages (amounting to £5,382) had been owing to increased grants made to the principal clerks and officers of the company, in accordance with a previous resolution that so soon as the traffic reached half a million such increase would be granted. The travelling expenses had also been heavy, owing to the fact that a large number of their staff had now become entitled to leave of absence after periods of five or six years' foreign service. After commenting on other of the subordinate details, the Chairman said that having made those remarks on particular points of the report, he thought he might make a few general remarks which would be interesting to the shareholders. He continued: The first is as to the state of our cables. Well, during the last year we have had more than an ordinary amount of repairs to make, more particularly in the Bay of Biscay. We have had two steamers at work there, and it is, perhaps, the most prolonged repairs we have yet entered upon. But reading as I have, morning after morning, that the ships were obliged to run into harbour on account of the weather, I impute to the rough and continuously bad weather, the cause of the delay incurred in carrying out these repairs. We have received a communication only this morning from the captain of the *John Pender*, which is very satisfactory as far as it goes, though it would have been much more satisfactory had it announced that the cable had been repaired. However, he states that they are in harbour now through stress of weather, "but on the next occasion I propose grappling in 2,500 fathoms of water, over a splendid bottom; and, weather and sea permitting, I have every hope of being able to complete the repairs, as the cable is apparently in good condition." I may tell you that last week they had the cable on board the vessel from 2,154 fathoms of water, but the ship lurched and the cable went over. That was an accident that will occur, but it shows you, gentlemen, that we can really grapple a cable; and a thing is not lost if you know how to find it. Now, gentlemen, I hope any morning now, as we are likely to have finer weather, to hear news that the cable has been repaired. The next remark I have to make is as to the state of our cables in the Red Sea. We had two faults there in the Bombay cable. We have repaired one cable, the other fault we were going on to repair, but it so happened that at that moment the state of affairs in Egypt necessitated the bringing our steamer *Chiltern*, which generally is occupied in repairs of that nature, to Alexandria; and I think that those who are watching the state of affairs in Egypt will observe that the *Chiltern* has done a very great deal of good work (hear, hear). We may congratulate ourselves that without the *Chiltern* you would not have the same amount of news, and the Government would not have been able to guide and direct affairs as they have done, had it not been through the Eastern Telegraph system. The *Chiltern*, I may say, we have placed under the orders of Sir Beauchamp Seymour, the British Admiral, and she is now still doing good work, but I am sorry to say that the state of things in Alexandria has interrupted our system across the isthmus. Yesterday morning that interruption took place; but you need not be alarmed, because, from the foresight of your directors, we entered into a joint-purse arrangement some few years ago with the Indo-European Company that will carry us on till our connection with the East is re-established. I believe that the result of this crisis will be in all probability to give us increased security in our connection with the East. After stating that the Lipari cable was in the most satisfactory condition, Mr. Pender said: There is another point to which I desire to draw attention, that is the Trieste-Corfu cable. We have made such arrangements in connection with that cable as will be brought before you to-day by a resolution, to secure an incorporation of it with our system, which, I may say, is very important for us, looking to the great number of telegraphs which we have got in the Levant, that we should hold any new works of this kind in our own hands. At the extraordinary meeting, therefore, a resolution will be put to you —which I hope you will approve—which will enable us to secure the Trieste-Corfu Egyptian cable for ourselves. There is another concession to which I would also draw attention, and that is the Tripoli concession. That was one of the first cables laid from Malta to Tripoli, and it was laid much upon its own merits. In other words, certain traffic was likely to be secured so as to secure a fair return upon it. That cable was abandoned; it broke; and in those days the company was not rich enough to restore it. Time passed on, and I think one or two figures will justify you in thinking we are right in looking after this Tripoli-Malta concession once more. The exports in 1868 from Tripoli were £105,080; in 1878, they were £477,034; the imports in 1868 were £83,325; in 1878, £355,220. As to the shipping arrivals, in 1868 they were 262; in 1878, 858. The tonnage of arrivals in 1868 being 21,800; in 1878, 105,272. The departures in 1868 were 269; in 1878, 824, the tonnage of which was in 1868, 21,919; in 1878, 149,351 tons. Looking to this trade then, we are now likely to secure a very considerable return upon our outlay. We have been fortunate also in securing from the Porte a renewal of the concession, giving the Malta-Tripoli cable entirely into our own hands. This concession, then, is a very important one, and a resolution in regard to it will be put before you. Now, as to that very important question, the finances of the company, our debentures now are £882,000, partly in six per cents. and partly fives. We think that our property has now taken such a position in the market that we shall be able to float debenture stock at four per cent., so as to enable us to pay off the whole of our present debentures (hear, hear). A special resolution on the subject will also be brought before you, and we are going to ask you to sanction our issuing of debentures at four per cent. It is with a view to take a higher financial position, which, I think, we are fairly entitled to. We have other schemes, I may say, before us, which we may bring before you later. This only I wish you to understand, and it is a question of the progress of telegraphy. Telegraphs, I believe, must be laid to many other countries than those to which they are now laid, especially in our Indian and Colonial Empires. A demand for telegraphs will come, and I simply wish you to understand that this company will not be behind the demand when it does come. The Chairman concluded his speech by moving the adoption of the report, and recommending a declaration of a final dividend for the year ending 31st March last of 2s. 6d. per share and a bonus of 1s. per share, making a total distribution for the year of 5½ per cent. on the ordinary shares.

The Marquis of Tweeddale seconded the motion.

Mr. Stokes, after congratulating the meeting on the very favourable report which had been presented to them, and with the satisfactory progress of their business generally, asked what the Board considered a fair and reasonable sum to put to the reserve fund? It was now nearly half a million, and he would like to know to what figure they wished to carry it.

Mr. Rixon stated that he had only recently returned from the East, and he could assure the meeting that, for good order, management, and respectability, he had found no better class of men anywhere than the servants of the company there. He thought that the Board had earned the thanks both of the commercial future of the community and the public generally for the highly efficient state of their officers and staff.

Mr. Nicolson would like to know the latest information in regard to their interests in Alexandria. He believed that the position of the *Chiltern* at this crisis would show that their directors and their whole staff had had throughout only one thing in view, and that was the interests of Englishmen and of the country at large.

Mr. George Hurst said that their half million of reserve was certainly large, but at the same time he did not think it was so large as they should aim at obtaining. The security and safety of an institution like theirs required something very considerable to fall back upon. They must remember that the capital was 4½ millions, and accidents might occur which would render a large reserve fund indispensable to fall back upon. Their position at the present time was such, that under good management, like that of their existing board, their property was safe and secure as possible; their shares were almost equal to money in the funds, with the advantage of a better dividend. They should do everything in their power to strengthen their position, strong though it was, and if only in the course of a year or two they could get another half per cent. in dividend, nothing would be more satisfactory than the company's position.

Mr. Munro thought that there should be some expression on the part of the meeting of its sense of the efforts made by the staff at Alexandria during the present crisis. Some expression of that sort would encourage their *employés* in their situation in such a post of danger as many of them then occupied. Soldiers and seamen who occupied such positions were made to feel by the notice they attracted that they were really acting a patriotic part; telegraph clerks, while doing their duty in quite as efficient a manner, were perhaps less the objects of observation, and he thought some expression of the satisfaction with which this company regarded the conduct of its staff during the late crisis would be duly appreciated, and would be no more than what the Board might gracefully do (hear, hear).

Mr. Newton asked whether the report was true that one of their principal officers had been slaughtered in the atrocities of the previous day at Alexandria?

The Chairman, in replying to the various questions, said that he could not give a direct answer to Mr. Stokes's query with regard to the maximum of the reserve fund. It was most desirable, looking to their capital, which taking their ordinary shares and their debentures together, amounted to five and a half millions, that they should have a very considerably larger reserve fund than they had at the present time. They had got a very handsome sum, it was true; but when they spoke of half a million, they must speak of the five and a half millions, too, which was spread over 16,000 miles of cables. Consequently, he thought they ought to be satisfied with a comparatively moderate dividend until their reserve was very considerably augmented. It was a very handsome sum they were putting by this year—£75,000—but he had stated at former meetings that they ought to aim at a yearly addition of £100,000. Besides, in increasing their reserve fund, if they did not get their money in dividends they got it in other forms. A stable reserve fund always attracted investments, and so their shares rose in the market. When they were adding £100,000 a-year to their reserve, he should be ready then to support any gentlemen who would then propose an increased dividend for the shareholders. With regard to Mr. Rixon's remarks upon the efficiency of the staff, he believed they were thoroughly well deserved. The First Lord of the Admiralty under the last administration of this country, Mr. W. H. Smith, had told him that he never felt prouder of his country than when, on a visit to the East, he had inspected some of the Eastern Telegraph Company's stations, the tidiness, neatness, and business-like arrangements of the offices, and the smartness of the young men there employed had given him such a high impression of the quality and manner of the work done. He himself (the Chairman) had never been more pleased than when, two days ago, the present First Lord of the Admiralty, who was one of the first men of business not only in the Cabinet but in the country,—he had that old business blood of the Barings in him—had told him the pride he felt as an Englishman at reading of how the *Chiltern* had the other morning picked up a cable and re-established their connection in the short time of two hours. As to another question put, he was sorry to say that they had that morning received a telegram stating that a young fellow—a Frenchman—all honour to him for it!—had stuck to his post in their offices at Alexandria till its destruction took place, and he himself was murdered. It was a painful story to tell, but one of those incidents that all wars carried

in their train. The board would certainly recognise the extraordinary devotion which the staff generally had shown to the interests of the company during the present critical period in the East. Mr. Pender, in concluding his remarks, stated that he believed that the result of the present crisis in the East, would be to secure for England a permanent highway to her Indian and Colonial possessions; and if that were the case they would require a more widely extended system of telegraphic communication.

Mr. Newton asked whether on the Eastern Company's Telegraphic system there was at present any means of communicating between Suez and Port Said?

The Chairman replied that before long a connection between these places would be made on their system. It might have been done before this time, but Government did not always move fast, owing to the routine of a departmental system. He might remark, when speaking of the East, that the Egyptian stock, in which they had invested a good deal of their reserve fund, they had sold at 91⅜ some time ago, though he did not believe that there was any fear of that stock being permanently depreciated. Egypt, no doubt, would pay her dividends; but, as the Board looked forward, they thought they would hardly be justified in retaining the stock which they held in the face of future troubles.

After a few remarks from Lord Alfred Paget as to the efficiency of the staff, which he had observed at Chios,

The Chairman put the resolution for the adoption of the report and the declaration of the dividend to the meeting, and it was carried unanimously.

The Chairman then announced that the next resolution, which had just been drafted, was "That this meeting desires to record its thanks to the staff of the company for their services during the past year, and to declare its high appreciation of the great labour and anxiety which the company's officers have recently undergone, and of the zealous and efficient manner in which they have performed their duties under most trying and difficult circumstances."

The resolution was seconded by Mr. Munro, and carried unanimously.

The Chairman announced that that concluded the business of the ordinary meeting.

Immediately on the close of the ordinary meeting an extraordinary general meeting was held to consider resolutions sanctioning the acquisition by the company of the Trieste-Corfu Telegraph Cable and Concession, and the laying of a cable between Malta and Tripoli, and also authorising the creation and issue of mortgage debenture stock of the company to an amount not exceeding one-third of the paid-up share capital for the time being for redemption of debentures and other purposes, and regulating its transfer and the powers of the company in relation to purchasing and dealing with it.

The Chairman said that the first resolution he had to submit was that the Board be and are hereby authorised to purchase and take over the concession from the Austrian Government, dated August 19th, 1881, referred to in the directors' report, dated July 3rd, 1882, for the establishment of a submarine telegraph cable connecting Trieste and Corfu, and a cable recently laid in pursuance thereof at a total cost not exceeding £67,000.

Sir James Anderson seconded the resolution, which was carried unanimously.

The Chairman said that the next resolution was that the meeting approves of the proposal of the Board to lay a new cable between Malta and Tripoli, as mentioned in the directors' report. He might just say that they had a certain amount of spare cable which they generally kept in reserve, and that they intended to utilise for this Tripoli cable, so that the cost of the whole would be comparatively small, and at the same time they might see from the figures he had given they might expect a very considerable result from the establishment of the line of communication.

The Marquis of Tweeddale seconded the motion, which was carried unanimously.

Mr. Birt, the solicitor to the company, then read a special resolution, which was as follows:—"Resolved (A), That the board of directors be and are authorised from time to time to create and issue mortgage debenture stock of the company to an amount not exceeding one-third of the share-capital of the company for the time being, issued and paid up, upon the terms that the aggregate amount of the said stock for the time being, in issue and the interest thereon shall rank *pari passu* as a first charge on the undertaking and revenue of the company, the stock to be issued at such times and in such amounts, and on such terms and conditions as the Board may from time to time determine; for the purpose of redeeming by exchange or otherwise, the outstanding debentures of the company, and any other purpose to which the capital of this company may be lawfully applicable." "(B). That the Board be and are hereby authorised to make such provision as they may think fit for the registration and transfer of mortgage debenture stock, and for the delivery of certificates thereof, and for the issue of stock warrants to bearer, transferable by delivery, and of interest coupons attached to such certificates or warrants, or otherwise, and for the conversion of warrants to bearer into registered stock, and of registered stock into warrants to bearer, and generally as to the form and incidence of all documents relating to the said stock, so that no holding of such stock be inconsistent with paragraph A of this resolution.

"(C.) That the board be and hereby are authorised from time to time to purchase in the market, hold, and deal with, any amounts of such mortgage debenture stock for the purposes of any reserve fund or investments of the company, and with the sanction of a general meeting to apply other moneys of the company to the purchase in the market of any such stock for cancellation, and with the like sanction afterwards to re-issue mortgage debenture stock in lieu of all or any of the said stock so cancelled, provided all of the amounts of mortgage debenture stock issued and outstanding should never exceed the limit prescribed in paragraph (A) of the resolutions." The resolutions having been put by the Chairman, the Marquis of Tweeddale seconded the motion for their adoption.

Mr. Marks said that before these resolutions were carried he should like to know whether they were really necessary. He saw no advantage in issuing bonds at 4 per cent. and purchasing stock at the same rate of interest. The credit of the company was good, and he thought they could pay off these debenture bonds with surplus profits for the year. He could see no benefit at all in the proposed issue.

Mr. W. Griffiths said that the distinction between floating capital and income was so marked that, unless they had a very large income, it was a mistake to lower dividends in order to pay back a certain portion of the capital. He hoped the Board would be supported in their proposal. There was no doubt that the present state of the company was somewhat critical; and they must congratulate themselves that they had a Board which possessed so much energy, fortitude, and foresight. He was very glad indeed when he heard that they had entered into a joint-purse agreement which enabled them to carry on business in the East independent of the political crisis then existing. The resolution read by the solicitor somewhat differed from the terms laid down in the report. The report spoke merely of the debenture stock. He would make a suggestion that it would be wise in the interests of the company generally that they should not confine themselves to debenture stock, but allow any person who wanted debenture bonds to have these instead of stock.

Mr. Birt said that Mr. Griffiths might take it from him that the proposal did not apply to anything but stock and warrants to bearer.

Mr. Griffiths would still press his suggestion. He thought that an option between debenture stock and bonds would be popular with the public, and would conduce to the interest of the company.

Mr. Newton thought the shareholders ought to be congratulated on the fact that it had been determined to issue 4 per cent. stock, though it was somewhat shaking the position of those who had 5 per cent. debentures. It would shake their position, because the Board could then mortgage the property which the holders of these debentures looked to as their security. But the advantages of that issue in other ways would be so great that if it were done their telegraphic property would become a substantially secure investment to investors generally.

Mr. George Hurst would support the views of the directors on the subject. There was one great advantage in having debenture rather than fixed stock, and that was that debentures could from time to time be paid off as a company increased in prosperity; and he did trust that in the course of a few years the debenture stock would be really cleared off as well as their reserve fund greatly increased. He would not mix up the reserve fund with the debenture stock, but keep the former to relieve them in any great emergency. They could not do better than pass the resolution submitted to them.

The Chairman said that they had considered this question most carefully during the last two or three months, and they really did think that the proposed issue was the best course to adopt. If they could float that issue they would be borrowing at 4 per cent. to pay off debentures at 5.

After a few remarks from Mr. Birt in further advocacy of the proposed course, the resolutions were put to the meeting and carried unanimously.

Mr. Newton moved a vote of thanks to the chairman and the board of directors for their efficient management of the said company's affairs, and he did so, though they all knew that he had been a severe critic of the board's procedure from the very commencement of the company.

Mr. Stokes seconded the motion, which was put to the meeting and carried by acclamation.

The Chairman briefly expressed his thanks on behalf of his colleagues and himself, and the proceedings terminated.

INDIAN AND ORIENTAL ELECTRICAL STORAGE AND WORKS COMPANY (LIMITED).

A GENERAL statutory meeting of the above company was held at the Cannon Street Hotel on Tuesday, the 11th inst., Mr. Ernest Noel, M.P., in the chair. The secretary, Mr. H. Cleland Heywood, having read the notice convening the meeting,

The Chairman said: Gentlemen, you are aware that by Act of Parliament a company must needs meet within three months of its allotment, and therefore this statutory meeting has been called. In an ordinary way I think it is best to say next to nothing on such occasions as these. I will merely say that the allotment of the shares has been made, and we have the pleasure of telling you that all the shares were allotted, and that the applications considerably exceeded the amount registered to be allotted. But what I really wish to say to you to-day is regarding something which has happened since the allotment of shares, something that I believe will be very much to the company's advantage. You have probably heard, or may have seen it in the newspapers, that an arrangement has been made by the Electrical Power Storage Company with the Faure Company. It is concerning this that I have to say a few words. In our prospectus we put forward what we considered a very important question in buying patents—that we had a guarantee from the vendors that our patents would stand. The only real fear we had was as regards any possible infringement of our patents by the Faure accumulator, and therefore we demanded from the Storage Company, who were the vendors, that our patents should stand. We had no doubt as to the superiority of our batteries over those of the Faure accumulator, but we had a fear that those batteries—Sellon-Volckmar batteries—might possibly have some infringement. They were well advised that there was no infringement, but still, there might be, and we made it a *sine quâ non* that we should have a guarantee. The scientific opinions we had regarding our own batteries were very satisfactory, especially that of Mr. Cromwell Varley, a name well known in the electrical world, who, to use his own words, said, "It is a wonderful battery"; and I believe that the world will find out that the Sellon-Volckmar battery is a wonderful battery. There

was, however, a rival in the field, that of the Faure accumulator. We had no guarantee as to that—as to our company having no rivals. All that the vendors guaranteed was that the patents were valid. Shortly after the allotment we heard that litigation was threatened between the Faure Company and the Electrical Storage Company. After a time we further heard that these two companies preferred peace to war. I am not going into the question as to the arrangement made between these two companies. That is no affair of ours; whether it was wise or unwise is no matter to us. What were the details of that arrangement is really immaterial to us. All that we need to know is that an arrangement was made between these two companies that they should work together; but there was a question which was very important to us. Did this arrangement between the two companies have any effect on our company? Now it came to pass that the Storage Company, who had guaranteed the validity of our patents, had now become the possessors of the Faure patents and the patent rights of the Faure accumulator, as regarded practically the whole world, but at all events—I only speak of the part which belongs to us—of India and the East. This being the case, we felt it incumbent upon us to enter into negotiations with what I may call the parent company. Those negotiations were chiefly carried on through Mr. Sellon, the gentleman whose name stands at the head of our patents—Sellon-Volckmar battery. I assure you that such negotiations were carried on in a manner of great fairness and uprightness. Any one who knows Mr. Sellon, knows that in dealing with him you are dealing with a man not only of remarkable cleverness, not only a great inventor, but a gentleman of remarkably upright and straightforward character, therefore in dealing with him I felt that I was secure in dealing with one who would treat this company fairly. I may say more, that though these negotiations were carried on chiefly through Mr. Sellon himself, the Electrical Storage Company met our company in an extremely honourable and more than conciliating manner. They met us in a way which I can only characterise as wishing to treat us with the favour that a father might treat his eldest son. They had taken great interest in the formation of this company, and they had a full belief in this company, as I will show you in a few moments, and therefore were determined to ascertain to a certain extent what might have been their rights, and to pass over to this company the whole of the patent rights of the Faure Accumulator Company as regards India and our other territories. The terms for which this important concession was given—and I will explain how it was an important concession in a moment—were simply these: As regards the whole amount we were to pay to the Electrical Storage Company it remained the same. The only difference which they demanded of us was a variation to the mode in which the payment was to be made. In the first place, you are aware, as you could see in our prospectus, that we were to pay £25,000 by way of royalty. This royalty might have been spread over some time, it might possibly, if we were not very successful, have been spread over some years. We have, however, now made an arrangement with them that that £25,000 for royalty should be paid within twelve months by instalments. There was another arrangement which you may recollect in our prospectus, that we were to pay £50,000 in shares, with the option of paying it in cash. Most vendors are anxious that they should be paid in cash. I have very rarely heard of a vendor company that was specially desirous of retaining the shares, or having the shares of any subsidiary company given to them, but, as I said just now, the Storage Company think well of us. I think they have reason to, but, at all events, they do think well of us, and they were desirous that they should have part of the option, as regards 5,000 of these shares, or £25,000 taken away, that we should hand over to them that £25,000 in shares without our having the option of paying them in cash. We thought that this was a very fair concession to make, and therefore as regards the option of half the shares we were to transfer to them, we have given it over to them, and they will certainly now be given 5,000 shares, and the remaining 5,000 shares will be given in shares or in cash, as we may elect. Beyond that we have paid nothing for what I shall now in a very few words try to point out are the advantages we have gained from the concessions we have obtained. I may say at once that these concessions would not have been granted to a company differently situated from ourselves. It was only in consideration of the special guarantee they had given us and the consideration that we had so early entered into the field in these negotiations that the Storage Company felt themselves justified in making such very easy terms with us in this manner. But perhaps some one will say, What is the advantage of the Faure patents to us, as you say yours are the better of the two? I do say, and I strongly affirm it, and I believe that the world will know it ere long, that the Sellon-Volckmar as secondary batteries are very much better and far stronger, and therefore are of far more commercial importance, than the Faure; but in saying that I don't want to detract for one moment from the value of the Faure accumulator; and the Faure accumulator having some advantages which the Sellon-Volckmar has not, inasmuch as the Faure accumulator is known, I may say, almost throughout the world, whereas, however much it may be known hereafter, the Sellon-Volckmar battery is at the present moment not known, though we hope it very soon will be; therefore there is that great advantage that we are now possessors of a patent so well known and so highly thought of as the Faure accumulator. There is also another great advantage, an advantage that is not to be lightly estimated by us, and that is the advantage that we get rid of what at present appears, and I believe I may say appears almost positively, the only litigation we could have entered into as regards any one attacking us. We may have eventually to enter into litigation to prevent our patents from being pirated; but as regards any attack on us, by having become the possessors of the patent rights of the Faure accumulator we have got rid of all litigation. There is something still further than that. We have also got rid in India, at all events for a time, of what would have been a rival. We have now possession of the sole accumulators that are commercially of value. I am not prepared to say in the present state of electrical science that there may not be in the future some better mode of storing electricity than by our battery, all I can say is this, that at present there is none known, and as far as we can see there is not one likely to be discovered for some time to come that will not be an infringement of our patents. For some time, therefore, we certainly have a monopoly of what are perhaps the most important rights that there can be in the present condition of electrical knowledge. There is something else. In addition to all this, and I think this alone would show that we have obtained in these patents something of real value to our company, it enables us to manufacture our batteries at somewhat less cost. I cannot go into the details of that, and you must merely take it from me, but I have it on good authority that the manufacture of our Sellon-Volckmar batteries, which are the ones we shall continue to hold and use, may be somewhat improved, but will certainly be somewhat cheapened in the production; and that is so much clear profit to us in future. I cannot say what may be the future of electrical science, I cannot say what may be the future of either the use of electricity, or the means of storing electricity, but I can say this, and I think we may congratulate ourselves on it, that already it has been proved that the storage of electricity is a great advance in the progress of mankind in enabling us to lay hold of some of the powers of Nature, which up to this time we had not been able to lay hold of. As just one illustration I may say that we are at this moment engaged in negotiations—I may say negotiations are very nearly completed, and I trust to get a telegram very soon to say that they are completed—by which we shall be the possessors of the natural forces of a waterfall in one of our territories, and the horse-power in that waterfall will be at once transmuted into two things. One will be the lighting of a town, which will be done by a company that is ready to give us orders for batteries for that purpose, and the other will be the motive power in carrying out some important Government works in its neighbourhood. This is only just an illustration of what is in store for us. Our field is great. I believe there is no company except in our own country that will rank higher than our own as to the territories we possess. I believe there is an opening in India both for electric lighting and the use of electricity as a motive power that is not surpassed in any other country in the world.

Therefore, I think, we can look forward as perfectly knowing the difficulties we have got to encounter, difficulties from the inexperience of our electrical engineers, difficulties of all sorts that must be encountered when a new power, as it were, is brought under the dominion of man, and is being wrought as a commercial undertaking. But taking the most sober view of all these difficulties, we are quite prepared to encounter them. I think I may say with confidence that there is a very bright future for this company. There was just one point that I omitted to say anything on in speaking of the terms of becoming the possessors of the patent rights of M. Faure, and that was this—that of course the Electric Storage Company is now required to give a guarantee. We forego that guarantee then given us, because our board considers that we have really secured something far better than the guarantee, those patent rights which alone might have endangered our patents. I do not think there is any other question that I need touch upon to-day. I hope when we meet next year that I shall not have to do so—in fact I feel confident when I have the honour of addressing you then—not to speak of what we hope to do and what we may do, but of what we have done, and I think I look forward with very considerable hope to be able to say something that will be very gratifying to the shareholders of this company. I will just ask Lord Crawford, one of our directors, who is well known in the electrical and scientific world, to say a few words as regards the batteries themselves, which may be interesting to the shareholders.

Lord Crawford said: It would be very difficult to say anything on the subject of batteries without actually going into a long scientific exposition of their method of construction and use, because your chairman has already laid before you in detail the use of these batteries and the methods how they may be used. Without actually going into the practical mechanical differences between the Sellon-Volckmar and the Faure accumulator, I think, unless I were to do so, there is very little left for me to say. I am sure Mr. Noel has gone most carefully into the whole matter, and has told you exactly what is the state of the company's work. There is one thing which is practically self-evident to any one who studies electric lighting, or has anything to do with electricity, and that is the absolute necessity that there should be the means of producing electricity at a certain given time, and so putting the electricity away or storing it until such moments as you may desire to use it (hear, hear). But some means of doing this there must be. I speak not of the electric lighting of docks or of the streets, but for domestic use, or in places which could not be characterised as large places. Under such circumstances it is practically and commercially impossible to have the domestic lighting of rooms, &c., under proper control without having these storage cells whereby during the day you may put away your electricity and use it at any moment you like. I have no doubt that these storage cells, or Faure accumulator, is the only practical way of doing that. When, a few years ago, the Faure cell made a very great sensation—a sensation, I may say, throughout the world, a sensation which set busy brains at work, and clever men—Mr. Sellon produced a battery which many people say is superior to the Faure. I do not wish to go into the merits of the two, because we are practically friendly. But certainly, whether or not the Sellon is an improvement on the Faure, the Faure accumulator was the only rival that the Sellon had in the field when the arrangement was made between them. There have been batteries called storage batteries by number. You can store by decomposing water and letting it recompose itself again. You have then a force laid by, though with no great energy in it; and another thing, it is too costly to produce. The question then of these batteries, or rather, of the position of our company, is that we hold now the Sellon battery, which we may call No. 1, and we

also hold the Faure, which we may also call No. 1 with a star. I do not wish to draw any distinction between them. Especially when they are amalgamated, we have no reason to fear any danger of their being improved upon. The great difficulty of improving upon the Sellon battery is that so far as I recollect it will reproduce about 90 per cent. of the amount of energy you put into it. Giving out that amount, any person who wishes to improve upon it has only really 10 per cent. to improve upon, and that is very small indeed when you come to think of the difficulty of improving on a battery which actually does return 90 per cent. Further, I have been informed that the Sellon battery has never yet been asked to perform all that it can do. I do not think, Mr. Chairman, that I need delay the meeting any further.

The Chairman said: If any shareholder wants to ask any questions I shall be happy to answer them, though the present meeting is not like the next one, when many questions as regards our working will come up. I may say that we are commencing our work this week—at least I hope the first batteries will be delivered this week; they will certainly be tested this week, or at the beginning of next. We have purchasers for these batteries, and for as many as we are likely to obtain for the next few months. Before that time is over I have no doubt we shall have many more purchasers; and I can only anticipate that we shall not stay in want of those who so urgently demand what we have to supply. I am glad that Lord Crawford brought it out that incandescent lighting—I may be wrong, but I hold it very strongly—is simply an impossibility for domestic purposes without storage. I am connected with a company that is anxious to produce the incandescent light, and that company has stopped its incandescent lighting till it could obtain its storage batteries, because it was felt that it was unsatisfactory to have any light that you could not use just as you could use gas, as much or as little as you like, so that you have got your supply at hand, and have no fear of sudden extinction, or of the house being left in the dark by the failure of your engine or other apparatus. In fact, I think it must be self-evident to anybody who thinks of it, that storage is essential to a really effective mode of lighting our houses.

Mr. Boyd said that they had been told the effective resultant of the Sellon-Volckmar battery was 90 per cent. Could the chairman tell them what the effective strength of the Faure accumulator was?

The Chairman said he should not like to give an opinion on the Faure. Their own opinion had been that the Sellon was better, but they had not yet had the Faure batteries at work. He had often conversed with scientific men on that subject, and he himself had seen the Faure at work at Paris; but he felt that it was not just to those who thought highly of the Faure accumulator to give an opinion on the subject. He had no doubt that at their next meeting their experience would enable them to speak with some approach to certainty.

A vote of thanks to the chairman was then unanimously carried on the motion of Mr. Adamson, seconded by Mr. Kerkpatrick, and this having been briefly acknowledged, the proceedings terminated.

THE CUBA SUBMARINE TELEGRAPH COMPANY, LIMITED.

ACCORDING to the report to be presented at the meeting to be held on the 19th instant, it appears that the gross receipts for the half-year ended June 30th last, including the balance brought from last account, amount to £21,279 7s. 11d., and the gross expenditure to £5,782 9s. 11d., leaving a sum of £15,496 18s. to the credit of revenue account. Of this, the sum of £3,950 has been placed to the reserve fund, increasing that fund to £47,000. After providing for the preference dividend, a balance of £8,546 18s. remains, out of which the directors recommend the payment of a dividend on the ordinary shares at the rate of 8 per cent. per annum, free of income-tax, which will absorb £6,400, and leave £2,146 18s. to be carried forward to the current half-year's account. The directors have pleasure in reporting that the cables have continued in good working order. In the matter of the suit instituted against the Spanish Government at Havana for a return of the tax erroneously levied on the Havana-Santiago business, which was decided by the court there in favour of the company, and the decision appealed against to Madrid, appearance has been entered on behalf of the company, and the case is now on the list of the Section of the Contencioso in the High Council of State waiting to be heard. The date of the trial has not yet, however, been fixed. At the recent extraordinary meeting to fill up the vacancy in the office of auditor, caused by the death of Mr. Cowan, several shareholders remarked upon the inconvenience of having to call a special meeting in such cases, and suggested the expediency of altering the articles of association so as to provide against similar contingencies. The directors, in order to meet these views have, with the notice of the ordinary meeting, sent out a further notice of a special resolution, which will enable the shareholders, if they think fit, after the termination of the ordinary business, to effect a slight alteration in the articles to meet the case. The director who retires from the Board at this time is Mr. Alexander F. Low, who, being eligible, offers himself for re-election. Mr. Thomas Greenwood, the auditor who was elected at the extraordinary general meeting in May, in place of the late Mr. Cowan, also retires and offers himself for re-election.

THE ANGLO-AMERICAN BRUSH ELECTRIC LIGHT CORPORATION (LIMITED).—Notice has been given, that an extraordinary general meeting of the Anglo-American Brush Electric Light Corporation (Limited) will be held at the Cannon Street Hotel, London, E.C., on Tuesday, the 18th day of July, 1882, at two o'clock in the afternoon, when the subjoined resolution will be proposed. Should such resolution be passed by the required majority it will be submitted for confirmation to a second extraordinary meeting which will be subsequently convened. Proposed resolution: "That the 85th of the Articles of Association be repealed, and that in lieu thereof the following be henceforth the 85th of such articles: '85. The directors may from time to time of their own authority pay to the members in proportion to the amounts paid up, or credited as paid up, on the shares held by them respectively, such bonus and such interim dividends as in the judgment of the directors the position of the corporation justifies.'"

THE CONSOLIDATED TELEPHONE CONSTRUCTION AND MAINTENANCE COMPANY.—An interim dividend has been declared, at the rate of 10 per cent. per annum for the three months ending the 30th ult.

THE TELEGRAPH CONSTRUCTION AND MAINTENANCE COMPANY.—An interim dividend has been declared of 12s. per share to all shareholders on the register on the 10th instant.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations. July 12.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	4	24½- 25½	25⅝ ac.
		Do. Do.	10	47 - 52	
150,000	1	Electric Light and Power Generator Co.	1	¼- ⅜	11-16 ac.
25,000	5	Great Western Electric Light & Power Co.	2½	1 - 1½	
24,980	5	Hammond Electric Light & Power Supply Co.	2½	11½-12½	11¾m. 11⅞ ⅞ ⅞ 12½ ½ 12 ac.
40,000	5	Indian & Oriental Electrical Storage Works	2	1½- 2½	2¼ ac.
40,000	5	Pilsen, Joel & General Electric Light Co.	2	1½- 2½	
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	50- 51	50⅞ 50m. 50⅞ ⅝ ⅛ ac.
2,441,800*l.*	Stk.	Do. Preferred } Def'd. receiving no div. until }	100	80 -81	80 m. 80½ 80 ac.
2,441,800*l.*	Stk.	Do. Deferred } 6 p. c. has been paid to Pref. }	100	19½- 20½	20½ ½ ½ ac
130,000	10	Brazilian Submarine, Limited	10	11½- 11¾	11⅝ ac.
16,000	10	Cuba, Limited	10	9½- 10½	9⅝ m.
6,000	10	Do. 10 per cent. Preference	10	16 - 17	
13,000	10	Direct Spanish, Limited	9	6½- 6¾	
6,000	10	Do. 10 per cent. Preference	10	15½- 16½	
65,000	20	Direct United States Cable, Limited, 1877	20	11½- 11¾	
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	101 -104	
380,000	10	Eastern, Limited	10	10½- 10⅝	10½ ⅜ ⅛ ac.
70,000	10	Do. 6 per cent. Preference	10	13 - 13½	
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1883	100	99 -102	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	101 -104	
200,000*l.*	100	Do. 5 do. do. Aug. 1890	100	102 -107	
199,750	10	Eastern Extension, Australasia & China, Limited	10	11 - 11½	11¼ ac.
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	100	107 -110	
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900	100	102 -105	
140,000	100	Do. do. registered, repayable 1900	100	102 -105	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	102 -105	
254,300*l.*	100	Eastern and South African Limited 5 per cent. Mort. Deb. Registered redeemable 1 Jan. 1900	100	102 -105	
345,700*l.*	100	Do. do. do. To Bearer	100	102 -105	
22,050	10	German Union Telegraph and Trust, Limited	10	9½- 10½	
163,390	10	Globe Telegraph and Trust, Limited	10	6½- 6⅞	
163,209	10	Do. 6 per cent. Preference	10	12½- 12¾	12⅝ ac.
125,000	10	Great Northern	10	12½- 12⅝	12⅝ m.
100,000*l.*	100	Do. 5 per cent. Debentures	100	100 -103	
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	26 - 27	
100,000	100	Do. 6 per cent. Debentures, 1883	100	101 -105	
17,000	25	Indo-European, Limited	25	28 - 29	28⅝ ac.
38,148	10	London Platino-Brazilian, Limited	10	4½- 5	
12,050	10	Mediterranean Extension, Limited	10	2 - 2½	
8,200	10	Do. 8 per cent. Preference	10	8½- 9	
9,000	8	Reuter's, Limited	8	12½- 13½	
280,000	Stk.	Submarine	100	265 -275	
58,225	1	Do. Scrip	1	2⅜- 2⅝	
4,200	Cert.	Submarine Cables Trust	100	100 -105	
37,350	12	Telegraph Construction and Maintenance	12	29 - 30	29½m. 29¾ac.
150,000	100	Do. 6 per cent. Bonds, 1884	100	102 -104	
186,750	5	Do. 2nd Bonus Trust Cert.	5	1½- 1¾	
30,000	10	West Coast of America, Limited	10	4¾- 5¼	
150,000	100	Do. 8 per cent. Debentures	..	.. ..	
69,910	20	Western and Brazilian, Limited	20	7 - 7½	
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	107 -113	
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80, red. Feb. 1910	100	99 -102	
1,500	$1,000	Western Union of U. S. 7 p.c.1 Mort.(Building) Bds.	$1,000	123 -128	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	102 -105	
88,321	10	West India and Panama, Limited	10	1½- 1¾	
34,563	10	Do. 6 per cent. 1st Preference	10	8 - 8½	
4,669	10	Do. 6 do. 2nd do.	10	6½- 7	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	1⅜- 1⅝	
200,000	1	Oriental Telephone Co., Nos. 100,000 to 300,000	½	⅜- ½	
100,000	5	United Telephone Co.	5	11¼-12½	11½ ⅝ ⅝ 12. 11¾ ac.

* Exceptional amount at special price.

TRAFFIC RECEIPTS.

The Cuba Submarine Telegraph Company, Limited. The number of messages passing over the lines of this company during the month of June was 3,022, estimated to produce £2,900, against 2,757 messages, producing £3,837, in the corresponding month of last year. The traffic receipts for the months of March and April, estimated at £4,000 and £3,800, realised £4,123 and £3,921.

The Brazilian Submarine Telegraph Company. The traffic receipts for the week ending June 10th were £3,547, against £3,072 in the corresponding period of last year.

The Direct Spanish Telegraph Company, Limited. The estimated traffic receipts for the month of June, 1882, are £1,953, as against £1,456 in the corresponding period of last year.

The Eastern Telegraph Company. The receipts for the month of June were £46,450, against £40,074 last year.

The Eastern Extension Telegraph Company. The receipts for the month of June were £31,122, against £29,339.

Great Northern Telegraph Company. The traffic receipts in June, 1882, were £22,560 from the 1st January to 30th June, 1882, £115,560, and for corresponding months of 1881, £114,966, and 1880, £108,035.

West Coast of America Telegraph Company. The receipts for two months ending May were £6,100, against £5,050 in the same period last year.

Western and Brazilian Telegraph Company, Limited. The traffic receipts for the week ending June 16th were £1,816, against £2,066 last year. The traffic receipts for the week ending June 30th, 1882, were £1,477, both after deducting the "fifth" of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

West India and Panama Telegraph Company, Limited. The estimated traffic receipts of this company for the half-month ended the 30th June are £2,605, as compared with £2,232 in the corresponding period of 1881.